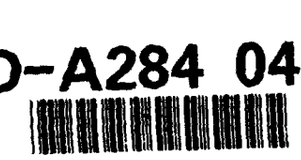

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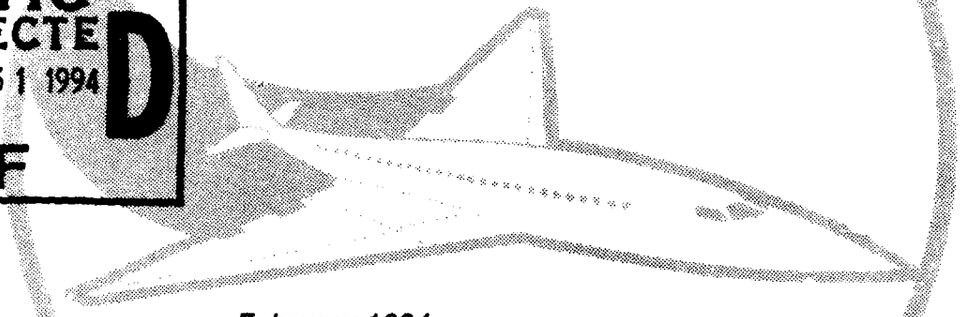
FAA Technical Center
Atlantic City International Airport,
N.J. 08405

Independent Review of Aviation Technology and Research Information Analysis System (ATRIAS) Database

Ronald John Lofaro, Ph.D.



February 1994

Final Report

U.S. Department of Transportation
Federal Aviation Administration

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16. Abstract

This technical report presents the findings of a critical review of the Aviation Technology and Research Information Analysis System (ATRIAS) for its capability to support the Federal Aviation Administration (FAA)/Aviation Security Research and Development Service's (ACA) Explosive Detection Systems (EDS) programs and Aviation Security Human Factors Program (ASHFP). This review was conducted by an independent consultant selected by the FAA. Section 1 of the report gives a descriptive overview of the ATRIAS analysis and reporting system. The findings of the independent review are contained in sections 2 and 3 of the report. Overall, ATRIAS was found to address many technology application areas relevant to the FAA's aviation security programs. However, the findings did recommend specific modifications to ATRIAS that will provide enhanced information collection and analysis for six topic areas of prime relevance to the FAA's EDS and ASHFP programs.

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LIST OF ACRONYMS AND SYMBOLS

3-D	Three-Dimensions
ACA	Aviation Security Research and Development Service
AI	Artificial Intelligence
ASHFP	Aviation Security Human Factors Programs
ATC	Air Traffic Control
ATRIAS	Aviation Technology and Research Information Analysis System
CAE	Computer-Aided Engineering
CASE	Computer-Aided Software Engineering
CASI	Center for Aerospace and Scientific Information
CBT	Computer-Based Training
CRM	Cockpit Resources Management
CT	Computerized Tomography
DBMS	Database Management Systems
DIALOG	Commercial On-Line Electronic Database
DTIC	Defense Technical Information Center
EDS	Explosive Detection Systems
EM	ElectroMagnetic
FAA	Federal Aviation Administration
FAATC	Federal Aviation Administration Technical Center
FIE	Federal Information Exchange
FLC	Federal Laboratory Consortium
HCI	Human-Computer Interface
HMPT	Human Factors, Manpower, Personnel, and Training Planning Tool
NAS	National Airspace System
NASA	National Aeronautics and Sp[ace Administration
NCAT	National Center for Advanced Technologies
NDI	Non-Destructive Inspection
NMR	Nuclear Magnetic Resonance
NQR	Nuclear Quadropole Resonance
NTIS	National Technical Information Service
PFN	Pulsed Fast Neutron
PFNA	Pulsed Fast Neutron Analysis
R&D	Research and Development
RA	Resonant Absorption
RE&D	Research, Engineering, and Development
RPD	Residual Polarization Detection

RRI	Relevant Research Item
SPEARS	Screener Performance Evaluation and Reporting System
SRM	Security Resource Management
TNA	Thermal Neutron Analysis

EXECUTIVE SUMMARY

This technical report presents the findings of a critical review of the Aviation Technology and Research Information Analysis System (ATRIAS) for its capability to support the Federal Aviation Administration (FAA)/Aviation Security Research and Development Service's (ACA) Explosive Detection Systems (EDS) programs and Aviation Security Human Factors Program (ASHFP). This review was conducted by an independent consultant selected by the FAA. Section 1 of the report gives a descriptive overview of the ATRIAS analysis and reporting system. The findings of the independent review are contained in sections 2 and 3 of the report. Overall, ATRIAS was found to address many technology application areas relevant to the FAA's aviation security programs. However, the findings did recommend specific modifications to ATRIAS that will provide enhanced information collection and analysis for six topic areas of prime relevance to the FAA's EDS and ASHFP programs.

Clearly, the development of a comprehensive and complete technology database covering all of the human factors issues associated with aviation security could require an effort so important that it might well be far beyond the scope of the currently envisioned security program. Therefore, the inclusion of the key words contained in this report should be considered as suggestive only and is intended to alert those involved in the development of the security program to a few of the potential problems and challenges that might be encountered during the establishment and operation of a reliable and cost-effective aviation security system.

1. INTRODUCTION.

1.1 OVERVIEW.

The Aviation Technology and Research Information Analysis System (ATRIAS) was developed to conduct comprehensive searches of technology resources and provide value-added analysis on research efforts of interest to Federal Aviation Administration (FAA) technical managers. Using a myriad of technical information sources, ATRIAS analysts collected information on recent and ongoing international Research and Development (R&D) efforts that could lead to the development of future aviation systems and operating procedures. Important technology information uncovered by the ATRIAS staff can be reported to the FAA using a variety of methods. These include formal, comprehensive, periodic reports, and shorter, quick-response reports that are more limited in scope and address the specific needs of individual FAA technical managers.

1.2 TECHNOLOGY APPLICATION AREAS.

The ATRIAS database is organized under 13 technology application areas that correspond broadly with the FAA's various Research, Engineering, and Development (RE&D) Programs. Included under these 13 application areas are over 200 critical technologies that are used as key word search terms for conducting ATRIAS bibliographic searches. The identification and classification of critical technologies under technology application areas were developed based on discussions with FAA technical managers and other expert consultants.

1.3 INFORMATION SOURCES.

The ATRIAS staff uses many technology and research sources to obtain the latest information on research and development that may be of great relevance to the FAA's RE&D programs. The sources include laboratories and other R&D facilities within government, private industry, and academia. Listed below are some primary technical data sources used by ATRIAS:

a. The Federal Laboratory Consortium (FLC),
b. The Defense Technical Information Center (DTIC),
c. The National Technical Information Service (NTIS),
d. DIALOG (Commercial On-Line Electronic Database),
e. The Federal Information Exchange (FIE) On-line Service,
f. The National Aeronautics and Space Aministration's (NASA) Center for Aerospace and Scientific Information (CASI), and
g. The National Center for Advanced Technologies (NCAT).

The ATRIAS staff also maintains an extensive reference library that includes professional journals, technical trade magazines, and various planning documents from the FAA and other government agencies involved in air transportation. Technical proceedings from various professional conferences and symposia are also maintained in the ATRIAS library.

1.4 SEARCH METHODOLOGY.

The ATRIAS staff develops search strategies for each area of investigation and conducts regular monthly searches using appropriate sources. Supplemental information searches are also conducted on a quick turnaround basis to respond to specific requests from FAA technical managers for high-priority technology information needs. Search strategies are continually refined to improve the information screening process, thereby reducing the time required to collect new information while ensuring that only the most relevant information is collected.

1.5 ANALYSIS PROCESS.

The ATRIAS staff analyzes the collected technology information based on its relevancy to the needs of the FAA and the aviation community as well as with respect to the expected time frame of its availability for incorporation in new systems and procedures. The analysis process used by the ATRIAS staff is designed to create value-added information that is readily usable by a broad spectrum of users in the FAA and the aviation community. The analyzed information items are categorized under a technology application area and critical technology, assigned a Relevant Research Item (RRI) number, and stored in a database. The information stored in the database is reviewed periodically to ensure that it remains pertinent to the needs of the FAA, and to update possible new applications of the technology. The database is designed to be used as an analytical tool by the ATRIAS staff to search for applicable information that can be used in the preparation of aviation technology information analysis reports as described in the preceding sections.

1.6 INDEPENDENT ATRIAS REVIEW.

The primary purpose of this technical report is to present the findings of an independent review undertaken to evaluate how the ATRIAS database and reporting system can be used to support the FAA Aviation Security Research and Development Service's (ACA) Explosive Detection Systems (EDS) and Aviation Security Human Factors Programs (ASHFP). The FAA selected the independent consulting firm of Hitchcock & Associates to conduct the review and make recommendations for modifications and input that will enable the EDS and ASHFP programs to better use ATRIAS. The findings of this independent review are contained in the following sections and appendices of this technical report.

2. REVIEW OF ATRIAS DATABASE.

2.1 INTRODUCTION.

This section provides an assessment of the applicability of the existing ATRIAS database information items to the area of aviation security. Special emphasis was placed on the assessment of those information items associated with human factors issues. Together with the analysis of the ATRIAS database, several documents were reviewed to establish the relevancy of the technical information cited in this report. They included:

a. ATRIAS Final Report, Human Factors Solutions, CDRL #A004, Contract No. F19628-92-C-0025, April 22, 1993.

b. Aviation Security Research and Development Plan, FAA Technical Center, March 1992.

c. Aviation Security Research and Development Program Management Plan, section 5 (Human Factors), FAA Technical Center, June 1993.

2.2 TECHNOLOGY APPLICATION AREAS.

Besides the Aviation Security technology application area developed specifically for ATRIAS, it was determined that various critical technologies found in other application areas could be applied to the development of effective aviation security systems. The ATRIAS application areas that include critical technologies applicable to the design and development of security facilities and operations are evaluated in the following subparagraphs.

2.2.1 Communications.

An effective security system will require frequent and time-critical exchanges of accurate information between all members of a security staff. The information transfer must be affected so that it does not distract the x-ray screeners from their primary task of screening carry-on baggage and/or passengers. Of the critical technologies listed under Communications, the following are the most relevant to the area of security systems:

a. Automatic Message Generation/Processing,
b. Optical Communications,
c. Communications Data Buses,
d. Speech Enhancement/Recognition Technology, and
e. Communication Networks Design Technology.

2.2.2 Surveillance.

In its Aviation Security Research and Development Plan, the FAA Technical Center (FAATC) describes in detail the types of efforts that would be required to enhance airport security. Controlling access to the various operational areas of a contemporary airport will involve using many of the same technologies and activities that will be required by air traffic control to oversee and manage surface movement in the airport area. As pointed out in the R&D Plan, the challenge posed by this surveillance requirement is to develop procedures that control the movement of vehicles and personnel, detect the intrusion of those who might prove to be security threats, and affect their interdiction without impeding routine operations at today's busy airports. Most of the topics currently being searched as indicated by the listing of critical technologies are of limited applicability to the area of security. The topics that could be of interest to airport security are:

a. Rescue and Firefighting,
b. Aircraft Ground Handling Simulation,
c. Access Roads and Parking, and
d. Terminal Designs for New Aircraft.

The references obtained by searching the following critical technologies should also be of interest:

a. Surface Surveillance,

b. Airport Intrusion, and
c. Intrusion Detection.

2.2.3 Information Management.

The data contained in this technology application area with the most significance for security activities are the references to automated information processing (decision-aiding) and the critical technologies related to the cost-effective and timely development, testing, validation, and implementation of information processing software. Nearly all of the critical technologies listed in this area are applicable to the development of security systems including:

a. Artificial Intelligence,
b. Data Compression,
c. Database Management Systems (DBMS),
d. Data Fusion,
e. Software Development/Engineering,
f. Hypertext, and
g. Operating Systems.

2.2.4 Computer Systems.

Clearly, the nation's next generation of aviation security systems will rely heavily on support from computer systems. Computers can help alert security staff to the appearance of known terrorist threats, they can also serve to aid in the detection and recognition of hazardous materials through signal analysis and pattern recognition algorithms. The critical technologies listed under this area that could prove useful in the development of aviation security systems include:

a. Data Storage Devices,
b. Computer Display Systems,
c. Computer Interface Systems/Standards,
d. Computer Networks, and
e. Real-Time Computing.

The following critical technologies, although of lesser overall importance, might demonstrate some potential for those concerned with the development of security systems:

a. Optoelectronics,
b. Neural Networks,
c. Superconductivity,
d. Supercomputers, and
e. Hybrid Computer Systems.

2.2.5 Human Factors.

All of the human factors topic areas addressed by the existing Human Factors application area within the ATRIAS database (see appendix A) have the applicability to the area of security system development. The extreme importance that any security system must necessarily place upon the

selection, training, and performance of its human components mandates a thorough examination of all aspects of the system's human engineering. The critical technologies in this area are:

a. Cognitive Science,
b. Decision Aids,
c. Display Integration,
d. Knowledge Presentation,
e. Human-Computer Interface (HCI),
f. Three-Dimensional Displays,
g. Human Performance, and
h. Automation Impacts.

2.2.6 Systems Engineering.

In section 4.2, Security System Integration of the Aviation Security R&D Plan, considerable emphasis is placed on the need to develop a coherent, interdependent aviation security system through the Security Systems Integration (SSI) program element. The components of this integrated program embodying threat assessment and risk analysis are already being covered by the critical technologies within the Aviation Security application area. However, such aspects of systems engineering technology as Computer-Aided Engineering (CAE), dynamic simulation, reliability and readiness, and maintainability should be as useful in the design of security systems as they are in the development of other types of Air Traffic Control (ATC) systems. The relevant critical technologies are:

a. Systems Management,
b. Computer-Aided Engineering,
c. Concurrent Engineering,
d. Design Automation, and
e. Automated Manufacturing.

The following search categories should be added to the previous group:

a. Simulation,
b. Computer Aided Design,
c. Computer Aided Software Engineering (CASE),
d. Functional Requirements,
e. Function Analysis, and
f. Function Allocation.

2.2.7 Aviation Security.

The existing list of critical technologies in the Aviation Security application area (see appendix A) is, by definition, fully applicable to the topic area of aviation security.

2.3 RELEVANT RESEARCH ITEMS RELATING TO OTHER SECURITY TECHNOLOGY AREAS.

A review of the RRIs contained in the ATRIAS database under the Human Factors application area was conducted. Those information items considered the direct interest to the security area appear in appendix B. The RRIs were grouped under seven security-related human factors topic areas analyzed in the following subparagraphs.

2.3.1 Training.

Eleven RRIs potentially pertinent to security staff training issues were identified. Clearly, additional searches would yield far more information that would be directly applicable to those who will be developing security training. Section 3.2.3 of this report will explain why special emphasis should be placed on the rapidly expanding area of computer-mediated instruction.

2.3.2 Display.

In subsequent searches, particular attention should be given to the potential advantages associated with the introduction of color and Three-Dimensions (3-D) into security display systems. In addition, the display issues researched should be expanded to encompass the visual displays provided to the security personnel responsible for airfield and airport terminal surveillance.

2.3.3 Decision-Making.

In the future, the complexity of threat detection, both in terms of the types of hazardous devices available and the number of potentially dangerous individuals, will become so complex and challenging that it will become essential to provide security staffs with computer-based "backup" systems. Artificial Intelligence (AI), including pattern recognition and 3-Dimensional (3-D) shape prediction, will be necessary adjuncts to screener display systems. In addition, automatic data management, retrieval, and correlation systems will be required to ensure the effective use of the security threat databases that will be developed.

2.3.4 Performance.

The continuous assessment and verification of x-ray screener personnel performance levels is a major component of the FAATC's Security Program Plans. Starting with the mandated use of the Screener Performance Evaluation and Reporting System (SPEARS), these plans emphasize the need to reliably monitor the efficiency of security personnel. This topic area is critical to the successful implementation and operation of effective aviation security systems. Therefore, it should be expanded to cover a broader range of potentially applicable items. Section 3.2.4 of this report includes a more in-depth discussion of this topic area.

2.3.5 Automation/Artificial Intelligence.

As previously stated, a successful aviation security system should take full advantage of the advances in computer-aided information management, utilization, and decision making. This topic area should be considered an important component of the security technology database.

2.3.6 Aeromedical.

In the future, it will be as important to passenger safety to ensure the mental and physical health of those supporting the security system as it is currently to monitor the condition and fitness of aircraft flight crews. Currently, there is no database of security-related medical information and experience comparable to that available for the pilot population. Until a new database can be created by the medical profession, the best alternative may be to select those items from the aeromedical world that are most applicable for assessing the mental and physical state of security personnel.

2.3.7 Cognitive Science.

While the consideration of the innate capabilities of the human component of a security system is critical to the design of an effective threat interdiction capability, the term "Cognitive Science" connotes such a broad area of interest that it is almost unwieldy to be of much use to those involved in security system development. It is recommended that more specific areas of research be developed for this topic area.

2.4 SUMMARY.

The purpose of this section was to present the results of a review of the critical technologies developed for the ATRIAS database, and to identify those critical technologies that should be relevant to aviation security development programs. In addition, this effort involved providing an assessment of the applicability of specific RRIs that had been collected under the Human Factors technology application area within the ATRIAS database.

3. ADDITIONAL ATRIAS SEARCH TOPICS.

3.1 INTRODUCTION.

This section outlines recommendations for modifying the ATRIAS database to include critical technologies for six additional areas of investigation. Technical information from these six areas could be extremely valuable in helping to guide the FAA and the aviation industry in the development of effective aviation security systems. Included for each of the six additional technology areas are lists of recommended key words for use within the overall search methodology.

3.2 RECOMMENDED NEW SEARCH TOPICS.

3.2.1 Security Personnel (Screener) Selection.

The detection efficiency of any security system that the FAA might elect to put into effect will depend directly upon the capabilities of the x-ray screeners who are selected to use and operate the system. This fact is recognized by the emphasis placed upon the development of selection test instruments and techniques by both the Human Factors section (section 5) of the FAATC's Aviation Security Research and Development Program Management Plan and the Human Factors section (section 4.2) of the FAATC's Aviation Security Research and Development Plan. To select the most capable people to operate and support the proposed security systems, the FAATC recognizes the need to develop selection tests for this purpose in Task 7.3, section 5 (Human Factors) of the Aviation Security Research and Development Program Management Plan). This plan further establishes a prerequisite need to support

the development of the required selection test(s) through the determination and cataloging of the basic activities and their associated abilities, skills, and traits, which the security personnel must perform. The key words that are associated with searches in these areas of technology are:

a. Selection,
b. Selection Tests/Testing,
c. Selection Criteria,
d. Test Development,
e. Task Analysis,
f. Task Requirements,
g. Abilities,
h. Traits, and
i. Functional Requirements.

It is assumed that any combination of these terms with the primary area of interest, security, would have been picked up during a search using that term itself. If not, these key words, and any of the others that follow, should initially be coupled with the prime key word, security.

3.2.2 Vigilance.

The basic nature of the security screening task is almost certain to impose a simultaneous demand for a sustained high level of attention and extreme, long duration task repetition. This combination will inevitably result in problems associated with operator vigilance. This possibility should be regarded as posing a critical concern for the successful implementation of the FAA's security program. Even the finest, most accurate, sensitive, and reliable sensor system could be developed and deployed but be completely useless if the operator's attention should be directed away from his/her display(s) at a critical point in time. The key words for this important topic area include at least the following items:

a. Vigilance,
b. Attention, and
c. Sustained Performance.

The opposite side of the vigilance coin should also be given attention:

a. Boredom,
b. Inattention,
c. Performance Decrement(s),
d. Error(s)/Error Rates, and
e. Response Bias.

Attention should also be given to items relating to the contributing causes for problems in the area such as:

a. Distraction(s),
b. Fatigue,
c. Time-on-Station, and
d. Work/Rest Cycles.

3.2.3 Training.

The need for security personnel training will be driven by both the inevitable expansion in the number of security stations that must be staffed, as more new airports are added to the system, and by the technological evolution of the range and complexity of the security systems themselves. It is virtually certain that there will be an increased interest in the cost-effectiveness of security training mediated through computer-based training (CBT). The newest approaches using the computer as a teaching aid allow for a greatly increased individualization of each student's instructional pace, subject matter emphasis, and topic review pattern. The use of computer instruction also supports through documentation of each student's progress and demonstrated skill level. The verification of an operator's level of competence can prove extremely valuable in the event of litigation that might well arise from the assertion that "human error" in some way contributed to a security related aviation disaster. In addition, it is possible to insert training materials and activities into digital based operations to provide continuous skill enhancement and assessment. The key words associated with this topic area would include:

a. Computer-Based Assessment/Performance Assessment,
b. Computer-Based Learning/Instruction,
c. Computer-Aided Learning/Instruction, and
d. Embedded Training.

The security related instructional material that would be provided by the computer mediated "teacher" would be based upon the same tasks, skills, and functional requirements data generated for the selection efforts already described.

Computer-mediated instruction can also serve as a counter to the previously mentioned problems with operator vigilance. The pseudo tasks presented, as part of the on-the-job learning experiences/ opportunities can serve not only as educational adjuncts but could well prove to be a means of maintaining optimum operator awareness.

3.2.4 Performance Decrements.

The Aerospace Medical profession has long been concerned with those aspects of pilot personality, physiology, behavior, and environment that might affect performance. Unfortunately, there is no corresponding history of such concerns relating to the performance of security personnel although the performance of this category of personnel could prove equally critical to aviation safety. For the time being, the security world will have to rely on the medical and health related information and practices developed for the evaluation and management of the pilot and aircrew population. The need for the creation of sensitive and reliable means for assessing the physical and mental state of security personnel is made even more critical since, while any pilot operating within the system will have been subjected to a long history of observation and evaluation during his/her training and qualification process, security personnel will probably be selected directly from the pool of available candidates and assigned to their duties almost immediately following the completion of their training. In addition, it is more than likely there will be a much higher turnover rate for security personnel than would be expected for the aircrew population that will further increase the pressure for reliable measures of the suitability and readiness of security personnel. Currently, the air transport industry is provided an element of protection by the barriers of existing regulations, examinations, and licensing practices, imposed by the government

through the FAA, against any litigation that might arise from an accident or incident. Compliance with this body of "law" constitutes the first line of defense against any charges of negligence in a company's selection, training, and/or supervision of its personnel. There is no regulatory foundation available to support the aviation security personnel system. Also, there is no question that the FAA must become actively involved in the development, enactment, distribution, and enforcement of the body of licensing standards and regulations that must be established to control the industry's many management actions involving security personnel. This body of regulation would have to provide guidance for both over the counter medications and controlled substances by security personnel similar to the current regulations governing a flight surgeon's supervision of their use by flight crews. While the demand for such a level of regulation may not surface immediately, it may well await only the first instance of fatalities associated with an aircraft's damage or destruction resulting from an explosive hazard that was not identified by a security screener who was impaired by alcohol, medication, or other drugs. It would, therefore, be in the FAA's best interest to anticipate this inevitable requirement and start now to prepare for it. Since the FAA is fully accustomed to the enactment of the regulatory process, there should be no need to include such basic and general topics as rule making, regulation(s), licensing, or standards in the ATRIAS technology database. However, it could prove useful to search on such topic areas as:

a. Medication Restrictions,
b. Medication Associated Performance Effects,
c. Drug Related Performance Effects,
d. Alcohol Related Performance Effects,
e. Prescription Drug Effects, and
f. Physiological Decrement(s).

Currently, there is considerable interest within the ATC community for the development and implementation of rapidly administered tests of a controller's immediate readiness-to-perform. The desired testing instruments would be performance-based rather than physiological in nature. As such, they would be both non-invasive and non-punitive. Thus, the privacy of the personnel tested would not become an issue and it would not be mandatory to report any "failure" to a legal authority for potential criminal action. Any member of the security staff that does not meet the minimum performance standard(s) on a given day would simply be sent home and not allowed to serve for that shift. It would not matter whether the reason for that failure was related to alcohol, drugs, loss of sleep, or was a consequence of a family problem or confrontation. Such an approach will have the advantage of both having a higher likelihood of acceptance by any employee union that might come to represent security personnel and of demonstrating the effective and responsible management oversight of the performance state of the security staff. This topic area would include such key words as:

a. Readiness-to-Perform,
b. Non-Invasive Testing,
c. Non-Punitive Testing,
d. Performance Testing,
e. Performance Prediction,
f. Computer-Based/Mediated Test(ing), and
g. Automated Performance Test(ing).

As previously stated, the requirement to assess the mental health of the security staff has the potential to pose a significant challenge to both the FAA and the aviation transportation industry. It is quite

possible that exploration of this area will represent more of an undertaking than the FAA would wish to consider at this time. However, like the topic area of substance abuse, it is almost certain to become an issue at some time in the future as the result of a security failure related accident/incident. Should there be a decision to investigate this area further, the following key words should be included in the search listing; all relating to their impact upon the employee's job/workplace performance:

a. Abnormal Behavior,
b. Mental Health,
c. Mental Health Screening,
d. Neurosis/Neurotic Behavior,
e. Personality Testing, and
f. Psychosis/Psychotic Behavior.

The impact of personality factors on the performance of aircrew has been studied extensively as part of the current interest in Cockpit Resources Management (CRM). It would appear that at least some of this general topic area's findings could have applicability to the task of creating and maintaining effective security staff interaction and performance. It seems reasonable to consider the development of a complementary CRM concept that might be labeled "Security Resource Management (SRM)." Optimum security can only result if there is the establishment of a climate of free and full communication and cooperation between the screeners, baggage handlers, ground crews, flight crews, counter agents, airline operations, and airport security personnel. Using FAA Advisory Circular 120-51A, "Crew Resource Manager's Training," February 10, 1993, as a guide, it is suggested that the acquisition of useful references in this area would involve a search based upon the following key words:

a. CRM,
b. Cooperation,
c. Crew Interaction,
d. Emergency Management,
e. Group Climate,
f. Group Interaction(s),
g. Group Processes,
h. Interpersonal Communication,
i. Leadership/Followership,
j. Personnel Interface/Interaction, and
k. Personality and Job Performance.

There is a need to evaluate and verify the routine performance of security staffs. According to section 5 (Human Factors) of the Aviation Security Research and Development Program Management Plan (see section 3.2.1), such an evaluation scheme would revolve around the enhancement and application of the procedures and protocols proposed for the SPEARS. This evaluation program's activities could be accessed through the key words:

a. Scanner/Screener Performance,
b. SPEARS,
c. Performance Evaluation,
d. Proficiency Evaluation/Testing,
f. Job Evaluation Procedures/Protocols,

g. Performance Protocol(s), and
h. Performance Test Development.

3.2.5 Domestic Passenger Profile Development.

Section 5 (Human Factors) of the Aviation Security Research and Development Program Management Plan calls for an investigation of the feasibility of the development of personality, behavioral, and appearance profiles of potential terrorists (see section 3.2.2, Domestic Passenger Profiling). Such profiles would help security personnel identify potentially hazardous individuals and alert the security staff to any situations that might contain the elements of a security threat. The use of such profiles would support a "passive" mode of threat identification that could enhance airport security while imposing only a minimum disruption of the activities of non-threat passengers. Such an implementation assumes that profile criteria and techniques can be developed which are both highly reliable (will identify all, or at least almost all, of the potentially hazardous passengers) and will still impose only a minimal inconvenience to the airline passenger population as a whole (result in few or no false positive). Besides the challenges posed by the development of passenger profiling systems, both techniques and procedures, section 5 (Human Factors) of the Aviation Security Research and Development Program Management Plan also asks questions about the ability of ticket agents and baggage handlers to accomplish such "passive profiling" tasks. The plan also asks questions about the ability of skycaps to apply profiling criteria to the passengers upon whom they are dependent for tips. If the profile development proves to be successful as a domestic screening technique, the plan contains a recommendation for the development of a corresponding screening procedure for use in international flight operations. The key words associated with this topic area would include:

a. Personality Profile(s),
b. Passive Profiling,
c. Personality Screening,
d. Profile Development,
e. Profile Test/Validation,
f. Terrorist Appearance,
g. Terrorist Behavior,
h. Threat Identification,
i. Behavioral Screening, and
j. Passenger Profiles/Profiling.

3.2.6 Decision-Aiding.

The general topics of artificial intelligence and decision aiding have been covered by the previous Human Factors topic listings. However, to provide additional information that could assist in the design of security threat detection and identification systems, additional search key words could prove to be valuable:

a. Pattern Recognition,
b. Signal Analysis,
c. Shape Recognition, and
d. 3-D Displays.

3.3 SUMMARY.

Clearly, the development of a comprehensive and complete technology database covering all of the human factors issues associated with aviation security could require an effort so important that it might well be far beyond the scope of the currently envisioned security program. Therefore, the inclusion of the key words contained in this report should be considered as suggestive only and is intended to alert those involved in the development of the security program to a few of the potential problems and challenges that might be encountered during the establishment and operation of a reliable and cost-effective aviation security system.

4. REFERENCES.

1. FAA Advisory Circular 120-51A, "Crew Resource Manager's Training," February 10, 1993.

2. ATRIAS Final Report, Human Factors Solutions, CDRL #A004, Contract No. F19628-92-C-0025, April 22, 1993.

3. Aviation Security Research and Development Plan, FAA Technical Center, March 1992.

4. Aviation Security Research and Development Program Management Plan, Section 5 (Human Factors), FAA Technical Center, June 1993.

Appendix A

Critical Technology Lists

HUMAN FACTORS TECHNOLOGIES

COGNITIVE SCIENCE - That branch of behavioral science that concerns itself with human thought, particularly thought processing, problem-solving, and decision-making.

DECISION AIDS - Hardware and/or software that assists human decision-making capability.

DISPLAY INTEGRATION - Inclusion of various data display formats or content in combined forms.

KNOWLEDGE REPRESENTATION - The means of expressing information-laden content into a form usable by humans.

PERCEPTUAL SCIENCE - That branch of behavioral science that addresses the human sensing and processing of outside stimuli, such as visual, aural, and touch inputs.

PILOT'S ASSOCIATE - Software that can act in various capacities as an automated "copilot"/decision aid/autopilot/assistant.

CONTROLLER'S ASSOCIATE - Software that can act in various capacities as an automated air traffic controller/decision aid/assistant.

HUMAN-COMPUTER INTERFACE (HCI) - The means of communication between human and computer, including displays, controls, and software.

THREE-DIMENSIONAL DISPLAYS - Representation of data in three dimensions for more efficient comprehension by human operators.

HUMAN PERFORMANCE - Functioning in a workplace setting, particularly with a view toward accuracy, speed, reliability, and persistence.

AUTOMATION IMPACTS - Studies of the impact that automation has upon human centered systems and analytical methods that can be used to assess the degree upon those systems.

AVIATION SECURITY TECHNOLOGIES

NUCLEAR PHYSICS BULK DETECTION - Methods that excite, transform, or activate the nuclei of atoms in concealed explosives using some form of radiation that penetrates the surrounding object. Includes, but is not limited to, Thermal Neutron Analysis (TNA), Pulsed Fast Neutron Analysis (PFNA), Resonant Absorption (RA) methods, Pulsed Fast Neutron(PFN)/Radiography, Spectroscopy, associated particle methods, and Nuclear Resonance technologies.

X-RAY BULK DETECTION - Methods using x-rays or gamma-rays for non-destructive inspection (NDI) of the contents of checked and carry-on luggage to reveal contraband. Includes, but is not limited to, Computerized Tomography (CT), X-Ray Backscatter, Coherent X-Ray Scatter, High Resolution X-Ray methods, Enhanced X-Rays, High Speed X-Rays, and Fluorescence.

ELECTROMAGNETIC BULK DETECTION - Use of radio frequency resonance and other electromagnetic resonance techniques to scan baggage for contraband. Includes, but is not limited to, Residual Polarization Detection (RPD), Nuclear Magnetic Resonance (NMR), and Nuclear Quadropole Resonance (NQR) methods.

TRACE DETECTION - Methods for detecting the chemical and physical properties of explosives, such as volatility, molecular weight, and electron affinity by vapor sampling. Includes, but is not limited to, the following methods: chemiluminescence, mass spectroscopy, ion mobility spectroscopy, electron capture detection, flow immunosensors, olfaction, frequency modulated infrared spectroscopy, surface acoustic wave resonator, and chromatography.

WEAPON DETECTION - Methods to enhance the performance of metal detection techniques and alternate methods to detect nonmetallic handguns, as well as non-conventional weapons such as flammable liquids, and liquid explosives. Includes, but is not limited to, magnetic resonance and microwave dielectric techniques and millimeter wave technology.

NAS SECURITY - Technologies, systems, and procedures for all forms of physical and data security for the NAS. Includes, but is not limited to, such methods as airport security demonstration models, positive passenger baggage matching, secure voice communication, access control, intrusion detection, and vulnerability assessments. It also includes methods and technologies for computer systems and telecommunications security.

AIRCRAFT STRUCTURAL HARDENING - Determining the vulnerability of an aircraft and its occupants to a terrorist explosion on board an aircraft and reducing the vulnerability through modifications to the structure or components. Includes, but is not limited to, blast loading phenomena, damage assessment methods, analyses of aircraft critical structural elements and systems, studies of blast effects on aircraft structures and systems, risk analysis methods, and aircraft hardening techniques. Also includes studies of blast effects on aircraft baggage containers and baggage container hardening techniques.

AIRCRAFT ELECTROMAGNETIC HARDENING - Technologies, techniques, and methods for reducing aircraft digital electronic systems' susceptibility to hostile ElectroMagnetic (EM) environments. Includes, but is not limited to, EM threat analyses, EM threat parameterization, EM countermeasures techniques, and EM countermeasure parameterization.

SECURITY SYSTEMS INTEGRATION - Systems analysis methods and techniques for evaluating aviation security systems. Includes threat/risk modeling.

Appendix B

Security-Related

Relevant Research Items

TRAINING

RRI Control Number	Title
R07A008	Attention, Automaticity, and Priority Learning
R07L017	Survival Analysis: Training Decision Application Interim Technical Report
R07Z010	Pedagogical Strategies for Human and Computer Tutoring
R07Z011	System and Method for a General Purpose Architecture for Intelligent Computer-Aided Training
R07Z012	An Intelligent Instrument Flight Trainer with Computer Generated Speech
R07Z013	Intelligent Computer Aided Training and Tutoring
R07Z016	The Analytical Onion: Examining Training Issues from Different Levels of Analysis
R07Z018	Early Training Strategy Development for Individual and Collective Training
R07Z021	Intelligent Tutoring for Diagnostic Problem Solving in Complex Dynamic Systems
R07Z022	A Comparison of Four Types of Feedback During Computer-Based Training (CBT)
R07Z026	Requirements for an Automated Human Factors, Manpower, Personnel, and Training (HMPT) Planning Tool

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 01/01/91	RRI Control Number : R07A008

Title:
Attention, Automaticity and Priority Learning

Organization:	Point of Contact:
Name: Carnegie Mellon University	Name: See Summary
Address:	Phone #: 0
Pittsburgh, PA 0- 0	Source: Star Vol. 30, No.8, N92-17458

Availability Category: R		CR1-	CR2-	CR3-	CR4-

Relevancy:
Studies of cognitive learning patterns. Applicable to aviation training programs.

Summary:
Prahlad Gupta and Walter Schneider

It is widely held that there is a distinction between attentive and automatic cognitive processing. In research on attention using visual search tasks, the detection performance of human subjects in consistent mapping paradigms is generally regarded as indicating a shift, with practice, from serial, attentional, controlled processing to a parallel, automatic processing, while detection performance in varied mapping paradigms is taken to indicate that processing remains under attentional control. This paper proposes a priority learning mechanism to model the effects of practice and the development of automaticity in visual search tasks. A connectionist simulation model implements this learning algorithm. Five prominent features of visual search practice effects are simulated. These are: (1) in consistent mapping tasks, practice reduces processing time, particularly the slope of reaction times as a function of the number of comparisons, (2) in varied mapping tasks, there is no change in the slope of the reaction time function; (3) both the consistent and varied effects can occur concurrently; (4) reversing the target and distractor sets produces strong interference effects; and (5) the benefits of practice are a function of the degree of consistency.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/01/91 | RRI Control Number : R07L017

Title:
Survival Analysis: Training Decision Application Interim Technical Report, Jun 1990 - Mar 1991

Organization:
Name: University of North Texas
Address:

Denton, TX 0- 0

Point of Contact:
Name: Julia A. Stephenson
Phone #: 0

Source: Star Vol. 30, No. 4, N92-13582

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Study of task-memory performance by Air Force trainees. Applicable to training for various occupations in aviation.

Summary:
The life of a task in an airman's inventory of tasks performed has not been investigated. How long a task remains (survives) in an individuals task inventory is of interest for training purposes. Survival analysis can possibly be used to measure task survivability. However, survival analysis uses longitudinal data whereas the USAF Occupational Survey Program captures vertical data (i.e., a snapshot is taken of the work force at one moment in time). Nonetheless, because survival analysis can incorporate both time and censored data, it could provide useful information about task survivability. In this effort, a task survival data base was modeled by combining both occupational survey data and known attribution data. Survival analysis functions were then generated. Results show both that survival analysis can be used to study task survivability and that this approach produces accurate estimates of task life.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/90	RRI Control Number : R07Z010

Title:
Pedagogical Strategies for Human and Computer Tutoring

Organization:
Name: Princeton Univ.
Address:

Princeton, NJ, 0- 0

Point of Contact:
Name: Reiser, Brian J.
Phone #: 0

Source: STAR N91-14750, Vol. 29, page 860

Availability Category: R		CR1-	CR2-	CR3-	CR4-

Relevancy:
Intelligent tutoring technology could greatly decrease the training time for controllers for operational of future, automated ATC systems.

Summary:
This report considers the pedagogical strategies of human tutors and examines the implications of this work for research in intelligent tutoring systems. It briefly describes GIL, an intelligent tutor for simple LISP programming, and considers its effectiveness from the perspective of human tutoring strategies. Finally, it discusses the implications of research on human tutoring for the design of intelligent tutoring systems for problem solving.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 06/01/90 | RRI Control Number : R072011

Title:
System and Method for a General Purpose Architecture for IntelligentComputer-Aided Training

Organization:
Name: Lyndon B. Johnson Space Center
Address:
Houston, TX, 0- 0

Point of Contact:
Name: Loftin, R. Bowen; Wang, Lui
Phone #: 0

Source: STAR N91-13944, Vol. 29, page 707

Availability Category: M | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Intelligent tutoring computer-aided instruction technology could greatly reduce the training time for controllers for operation of future, automated ATC systems.

Summary:
An intelligent computer-aided training system having a general modular architecture is provided for use in a wide variety of training tasks and environments. It is comprised of a user interface which permits the trainee to access the same information available in the task environment and serves as a means for the trainee to assert actions to the system; a domain expert which is sufficiently intelligent to use the same information available to the trainee and carry out the task assigned to the trainee; a training session manager for examining the assertions made by the domain expert and by the trainee for evaluating such trainee assertions and providing guidance to the trainee which are appropriate to his acquired skill level; a trainee model which contains a history of the trainee interactions with the system toegether with summary evaluative data; an intelligent training scenario generator for designing increasingly complex training exercises based on the current skill level contained in the trainee model and on any weaknesses or deficiencies that the trainee has exhibited in previous interactions; and a blackboard that provides a common fact base for communicatin between the other components of the system. Preferably, the domain expert contains a list of mal-rules which typifies errors that are usually made by novice trainees. Also preferably, the training session manager comprises an intelligent error detection means and an intellient error handling means. The present invention utilizes a rule-based language having a control structure whereby a specific message passing protocal is utilized with respect to tasks which are procedural or step-by-step in structure. The rules can be activated by the trainee in any order to reach the solution by any valid or correct path.

See Also:

RELEVANT RESEARCH ITEM REPORT	Date of Report: 11/01/88	RRI Control Number : R07Z012

Title:
INFLITE: An Intelligent Instrument Flight Trainer with Computer- Generated Speech

Organization:
Name: Air Force Human Resources Lab.
Address:
Brooks AFB, TX, 0- 0

Point of Contact:
Name: Regian, J. W.; Dennis, M. M.;
Phone #: 0

Source: NTIS 1395965

Availability Category: 0 | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Contrary to the title, this item deals with design and development of an intelligent tutoring system for training high-performance tasks.

Summary:
Researchers at the Air Force Human Resources Laboratory (AFHRL) are applying a taxonomy of learning skills (Kyllonen & Shute, 1987) to the pedagogical issues surrounding Intelligent Tutoring System (ITS) design and development. The taxonomy provides us with a means of categorizing target domains and consequently specifying the appropriate training approaches for particular ITSs. Further, it highlights classes of domains for which ITSs are appropriate but have not yet been developed. This paper focuess on an application in an area that has only recently been explored: a class of tasks which we refer to as high-performance tasks (Regian & Shute, 1988). In high-performance tasks, there is greater requirement for highly speeded, reliable, and automatic task performance than is found in the typical knowledge-rich ITS domains (e.g., medical diagnosis, electronic troubleshooting). This paper describes an Instrument Flight Trainer (INFLITE) developed at AFHRL's Training systems Division to test the concept of using artificial intelligence to train high-performance tasks, INFLITE is in no sense a serious attempt to develop an application-ready instrument flight training device. Rather INFLITE is an experimental system designed for the purpose of evaluating a promising approach to training high-performance tasks. Our decision to use flight simulation as the prototype domain was guided by a desire to use an inherently interesting task to increase motivation in our experimental subjects. Keywords: Instrument landing, F-16 Aircraft, Computer aided instruction.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 11/01/90 | RRI Control Number : R07Z013

Title:
INTELLIGENT COMPUTER AIDED TRAINING AND TUTORING

Organization:
Name: UNIVERSITY OF HOUSTON - DOWNTOWN
Address: ONE MAIN STREET

HOUSTON TEXAS, 0- 0

Point of Contact:
Name: R. BOWEN LOFTIN, PH.D
Phone #: 0

Source: TECH 2000, CONF. PROCEEDINGS, VOL. 2, PP. 3-9

Availability Category: M | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
DESCRIBES USE OF AUTONOMOUS TRAINING SYSTEMS BASED ON AI TECHNOLOGY FOR USE BY NASA FLIGHT CONTROLLERS. A TECHNOLOGY THAT COULS BE APPLIED TO AIR TRAFFIC CONTROLLER TRAINING.

Summary:
A GENERAL ARCHITECTURE FOR ICAT SYSTEMS HAS BEEN DEVELOPED AND APPLIED TO THE CONSTRUCTION THREE ICAT SYSTEMS FOR DIFFERENT TASKS. USE BY NOVICES OF AN ICAT APPLICATION BUILT UPON THIS ARCHITECTURE HAS SHOWN IMPRESSIVE TRAINEE PERFORMANCE IMPROVEMENTS. WITH FURTHER REFINEMENT AND EXTENSION, THIS ARCHITECTURE PROMISES TO PROVIDE A COMMON FOUNDATION UPON WHICH TO BUILD INTELLIGENT TRAINING SYSTEMS FOR MANY TASKS OF INTEREST TO THE GOVERNMENT, MILITARY, AND INDUSTRY. THE AVAILABILITY OF A ROBUST ARCHITECTURE THAT CONTAINS MANY DOMAIN-INDEPENDENT COMPONENETS SERVES TO GREATLY REDUCE THE TIME AND COST OF DEVELOPING NEW ICAT APPLICATIONS. AS AN ADDED BENEFIT TO THE NATION, A TECHNOLOGY SPINOFF PROJECT HAS EMERGED FROM THIS ACTIVITY AND PROMISES TO MAKE A SIGNIFICANT CONTRIBUTION TO THE SECONDARY AND POSTSECONDARY EDUCATION.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/91 | RRI Control Number : R07Z016

Title:
The Analytic Onion: Examining Training Issues from Different Levels of Analysis Interium (T)

Organization:
Name: Air Force Human Resources Lab
Address:

Brooks AFB, TX 0- 0

Point of Contact:
Name: Theodore A. Lamb, Keric Chin
Phone #: 0

Source: Star Vol. 30, No.6, N92-15540

Availability Category: R | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Using multiple perspectives to analyze training issues. Applicable to various types of aviation training.

Summary:
The Analytic Onion: Examining Training Issues From Different Levels of Analysis Interim Paper, Jul. 1989 - Jun. 1991

The layers found in an average grocery store onion perhaps of the sweet Vidalia variety, are used as an analog for levels of conceptual analysis. This paper focuses on applying the Analytic Onion to training issues. The core of the analytic onion is the biological level, surrounded by the individual, the group, the organizational, community, societal, world system, and space system levels of analysis. Each level of analysis is discussed in the papers as well as the interactions between the levels. Disciplinary perspectives from biology, psychology, social psychology, political science, and sociology are presented. All of these disciplines are viewed as having contributions to make the examination of training issues when the focus is on the appropriate level of analysis. This paper presents these varied perspectives in unitary fashion and argues that using a single disciplinary perspective may result in missing many alternative training solutions to operational problems or solutions to training and operational problems which do not appear at first glance to be related to trainging or operations.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/91	RRI Control Number : R07Z018

Title:
Early Training Strategy Development for Individual And Collective Training Final Report (T)

Organization:	Point of Contact:
Name: Army Research Inst. for Behav. and Social Sciences	Name: Larry L. Meliza, Bruce Knerr
Address:	Phone #: 0
Alexandria, VA 0- 0	Source: Star Vol. 30, No. 6, N92-15542

Availability Category: D	CR1-	CR2-	CR3-	CR4-

Relevancy:
Report describes high-level model for designing a training program with modern training aids.

Summary:
Early Training Strategy Development for Individual and Collective Training Final Report, Oct 1989 - August 1990

The training strategy for a new weapon system identifies the training devices required, the tasks each device will be used to train, and the circumstances under which each device will be employed. Consideration of embedded training (i.e., use of operational equipment and training software to provide training) as the first option for new weapon systems forces early development of training strategies. Training development tools, such as the Optimization of Simulation-Based Training System, are available to support development of a training strategy, but an overall model is needed to show how the various tools can be integrated to support strategy development. This report describes a high level model for early training estimation that incorporates other training development tools. The benefits of this model include integration of individual skills training across duty positions, individual skills training with collective training, collective task training accross unit missions, and collective task training across echelons.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07Z021

Title:
Intelligent Tutoring for Diagnostic Problem Solving in Complex Dynamic Systems

Organization:	Point of Contact:
Name: Georgia Inst. of Tech.	Name: Vijay Vasandani
Address:	Phone #: 0
Atlanta, GA 0- 0	Source: Star Vol. 30, No. 6, N92-15546

Availability Category: D	CR1-	CR2-	CR3-	CR4-

Relevancy:
Study shows importance of intelligent tutoring systems for training of troubleshooting skills. Applicable to large aircraft and other complex dynamic systems.

Summary:
Maintenance training for diagnostic problem solving in complex dynamic systems is carried out either on the job or in simulators. When simulators are used for training, their effectiveness can be improved by integrating intelligent tutoring systems (ITS) into the training programs. Research results from ITS developed for simpler task domains are generally not very useful in complex engineered domains due to lack of appropriate knowledge representation techniques. The focus of our research is the development of a methodology for decomposing, organizing, and representing domain knowledge of complex dynamic systems for building functional computer-based intelligent tutors. Using our knowledge representation methodology, we implemented an ITS on an Apple Macintosh II computer for the marine power plant domain. The ITS is comprised of a simulated power plant, the tutor, and mouse-based direct manipulation graphical interfaces. The ITS was experimentally evaluated using Naval ROTC cadets as subjects. Performance of the subjects was analyzed using measures such as percentage of premature and correct diagnosis and percentage of relevant and irrelevant diagnosticj tests. Results and percentage of relevant and irrelevant diagnostic tests. Results show that a simulator alone is inadequate, whereas a simulator in conjunction with an ITS can help develop efficient troubleshooting skills.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 10/01/91	RRI Control Number : R07Z022

Title:
A Comparison of Four Types of Feedback During Computer-Based Training (CBT)

Organization:	Point of Contact:
Name: Navy Personnel Research and Development Center	Name: Michael Coun
Address:	Phone #: 0
San Diego, CA 0- 0	Source: Star Vol. 30, No. 4, N92-13579

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Use of CBT for operating sophisitcated equipment. Applicable to flight crews and ATC controllers.

Summary:
Navy personnal often have difficulty operating the state-of-the-art programmable equipment employed in radar systems, communication systems, and transportation systems. These types of devices tend to be designed without adequate consideration of the user interface. Computer-based training (CBT) systems have been developed to help users overcome difficulties associated with learning how to operate complex devices. An important capability of CBT is feedback that informs users about the correctness of their knowledge of device procedures. Current research in CBT provides little guidance as to when feedback mshould be provided and how to design feedback content. An experimental CBT lesson on how to operate a military phone system was administered to 80 Navy Students. The lesson was presented individually on a microcomputer and consisted of an introduction, a practice, and a performance test. During practice, each treatment group received one of four types of feedback. The computer provided feedback either immediately following an error or at the end of the button-pushing of the to-be-learned sequence. Feedback consisted of the correct response or a wrong indication. All the CBT treatment groups outperformed a no-treatment control group. The treatment group who received delayed feedback performed significantly better on the performance test than those who received immediate feedback. Delaying the feedback was beneficial during CBT because it aids in the development of a usable device shema.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 05/01/92 | RRI Control Number : R072026

Title:
Requirements for an Automated Human Factors, Manpower, Personnel, and Training (HMPT) Planning Tool

Organization:
Name: Vector Research, Inc.
Address:

Arlington, VA 0- 0

Point of Contact:
Name: Susan Evans, Nicole Richie
Phone #: 0

Source: Star V31/N7, N93-21753

Availability Category: | | CR1- | CR2- | CR3- | CR4- |

Relevancy:

Summary:
This Phase 1 Small Business Innovative Research (SBIR) project investigated the impact of system design decisions on human operator performance during concept development. The research established the functional and information requirements for an effective automated design analysis and crew performance assessment methodology for use in analysis and crew performance assessment methodology for use in Premilestone 1 planning. The information structure included process, task, dynamic crew performance, operator graphic and human factors parameters, and training requirements. Existing automated tools such as the IDEF sub) structured analysis methodology, the SAINT task network simulation model and various operator graphic and human factor models were evaluated, along with other proven methodologies such as IDEAL and the Air Force's Instructional Systems Development (ISD) process. Insights from designers and other potential users identified special functional, information, and hardware requirements which were included in the methodology. The requirements will direct the implementation of an automated Human Factors, Manpower, Personnel, and Training System in Phase 2. The resulting system will make a significant contribution to the complex problems of considering HMPT issues early in system planning. It has potential application by elements in DoD program offices and organizations, and would also be of use in the private sector by those who are involved with the early concept phases in the design of complex human-operated systems.. Manpower, Personnel and training, Human performance, Process modeling, IDEF, Simulation modeling, Concept exploration, system planning.

See Also:

DISPLAYS

RRI Control Number	Titles
R07A003	Efficacy of Color-Coded Symbols to Enhance Air Traffic Control Displays
R07C001	Three-Dimensional Perspective Visualization
R07C008	Inter Maphics Display System Software
R07D002	Tactical Control Display Modeling
R07D013	Techniques and Applications for Binaural Sound Manipulation in Human/Maching Interfaces
R07G001	Signal and Listener Based Factors in Complex Auditory Pattern Perception
R07G003	The Matching of Doubly Ambiguous Stereograms
R07J003	Acquisition and Production of Skilled Behavior in Dynamic Decision-Making Tasks (Semiannual Status Report)
R07L002	The Effects of Speech Intelligibility Level on Concurrent Visual Task Performance

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/88	RRI Control Number : R07A003

Title:
Efficacy of Color-Coded Symbols to Enhance Air Traffic Control Displays

Organization:	Point of Contact:
Name: Naval Ocean Systems Center	Name: Bemis, S. V.; Winer, E. A., Le
Address:	Phone #: 0
San Diego, CA, 0- 0	Source: NTIS

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Color coding & shape coding for symbology of data display as well as relevancy for improving controller performance.

Summary:
This research tested the effect of color-coded air-traffic control displays on working memory and accuracy performance. Color, as a primary code and as a redundant code, was compared with shape coding under memory and no-memory conditions at varying density levels (5.8.11. and 14 symbols per display). In the shape-coded condition, symbol shapes denoted the atltitude, or altitude and speed. All symbols had the same shape when color was used as a primary code. Only color denoted the altitude, or altitude and speed when color was tested redundantly. In the memory condition, subjects were required to remember the altitude and speed on each displayed symbol, and then sequence the planes in approach order to the landing area. Significant differences in recall accuracy shape coding, color, either as a primary code or as a redundant code, significantly improved recall accuracy when altitude alone was encoded on each symbol. When both altitude and speed were encoded on each symbol, color as a redundant code signifciantly improved recall accuracy for the 8 and 11 symbol density levels. Keywords: Data displays; Screens displays; color coding, shape coding, military-information displays, cognitive memory, altitude; speed; air traffic control system.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 11/01/90	RRI Control Number : R07C001

Title:
THREE-DIMENSIONAL PERSPECTIVE VISUALIZATION

Organization:	Point of Contact:
Name: JET PROPULSION LABORATORY	Name: KEVIN HUSSEY
Address:	Phone #: 0
, 0- 0	Source: TECH 2000

Availability Category: M	CR1-	CR2-	CR3-	CR4-

Relevancy:
DISCUSSES A WAY TO SIMULATE AND ANIMATE 3-D SURFACES FROM 2-D IMAGERY, A TECHNOLOGY THAT COULD PROVIDE ATC SYSTEMS WITH IMPROVED DISPLAY SYSTEMS.

Summary:
It has been demonstrated that image processing/computer graphic techniques can provide effective means of physiographic analysis of remotely sensed region through the use of 3DPR (three dimensional perspective rendering). This talk will explain methods used to simulate and animate three dimensional surfaces from 2-dimensional imagery and digital elevation models. A brief historic look at JPL's efforts in this field and several examples of animations illustrating the evolution of these techniques from 1985, will be shown. JPL's current research in this area will also be discussed along with examples of technology transfer and potential commercial application. The software is part of the VICAR (Video Image Communication and Retrieval) image processing system which was developed at the Multimission Image Processing Laboratory of JPL.

Current Research: Along with continuing to improve the ease of use, speed and quality of the 3DPR techniques they are adding additional capabilities to the 3DI program. These capabilities include the ability to interactively fly over very large data bases under joy stick control and to interactively perform basic analytical functions on user selected areas of the 3DPR images being displayed. (The level of interactivity will be, in part, a function of the workstation being used.) Volumetric visualization of oceanographic data is also being pursued in the 3DI context. This work is being accomplished under UNIX in an X-window environment.

Intial Technology Transfer: JPL to Syracuse Corporation (SRC). A task to transfer the 3DPR capability described above to private industry has begun. SRC is funding a portion of the current visualization research taking place at JPL in return for a license to utilize the prototype technology developed for commercial applications. The benefits to JPL are two fold. First, it provides additional funds for research an second SRC becomes an active participant in the research, through their own independent development, and exhaustive testing of the new capabilities.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 07/01/91	RRI Control Number : A07C008

Title:
INTER MAPHICS DISPLAY SYSTEMS SOFTWARE

Organization:	Point of Contact:
Name: PRIOR DATA SCIENCES	Name:
Address: 240 MICHAEL COMPLAND DRIVE	Phone #: 613
KANATA ONTARIO,, 0- 0	Source: ATCA MONTHLY NEWSLETTER

Availability Category: 0		CR1-	CR2-	CR3-	CR4-	

Relevancy:
SOFTWARE PRODUCT DESIGNED FOR DEVELOPING C2 DISPLAYS

Summary:
Prior Data Sciences of Kanata, Ontario, Canada will market its software product "InterMAPhics" to the worldwide graphics market. InterMAPhics is a software product designed for developing command and control display systems which present dynamically changing information on a geographic background. It consists of a run-time component with function libraries, and an off-line set of utilities for the generation of the configuration data. InterMAPhics allows application programmers to work at an object level which frees them from the concerns and tedium of programming the graphics and user interaction software. This represents substantial contributions to programs with demanding real-time display requirements such as in CI, air traffic control, air defence, mission planning and training. InterMAPhics is a unique off-the-shelf product for demanding interactive display requirements. It allows program managers to complete customized systems on time, and on budget.

See Also:

Date of Printout: 01/14/96

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/89	RRI Control Number : R07D002

Title:
Tactical Control/Display Evaluation/Modeling

Organization:	Point of Contact:
Name: Armstrong Aerospace Medical Research	Name: Venturino, M.
Address: Laboratory Visual Display Systems	Phone #: 513
Wright-Patterso, 45433- 0	Source: DTIC

Availability Category: R	CR1-	CR2-	CR3-	CR4-

Relevancy:
Describes effort by armstrong lab to develop a technical data base of perceptual concepts necessary for development of new approaches to information display.

Summary:
Objective:(U) Development and empirical evaluatin of advanced control/display concepts based on the spatial/temporal configuration and portrayal (e.g., pictorial symbolic) of task critical information with respect to the perceptual and psychomotor capabilities of the operator. The approaches to displayed information will be developed based upon inference from existing models of human information processing, attention and workload.

Approach: (U) A. Evaluate and select existing operational control/display problems involving information acquisition, processing and pilot workload. B. Review and evaluate existing models of information processing attention and workload for applicability to design and system performance issues. C. Consult and exploit developing technical data base (71842603) and existing laboratory technical resources with respect to the variables which affect the sensory acquisition and perceptual processing of information (e.g., physical characteristics of the environment or display, operator workload and experience). D. Develop advanced control/display concepts (i.e., visual aural, proprioceptive) based on known and demonstrated principles of perception. E. Conduct empirical studies to evaluate these concepts and fill gaps in the technical data base considered necessary for development of new approaches to informatin display.

Progress: (U) Startdate-01-Sep-88 enddate-31-Aug-89 three more in-house experiments investigating the effects of instantaneous field-of-view (FOV) upon situatin awareness and spatial awareness have been conducted. These experiments have evaluated performance under increased task complexity. The results show that as the task becomes more difficult, the need for a larger FOV becomes greater. A second area of investigatin is the use of virtual display technology to portray aircraft attitude. Multivariate statistical analyses have been completed on an experiment that compared eight different attitude displays. A final report is currently being written that summarizes these complex findings. Additionally, a second is currently being written that summarizes these complex findings. Additionally, a second experiment in this area is presently being conducted, where various display formats are compared in recovering from a more dynamic uncontrolled aircraft spin. In support of research conducted in the helmet mounted oculometer facility (HMOF), an in-depth analysis of alternative criteria for defining the beginning of eye and head movements was conducted. Also, over 50 statistical routines were developed and used in the analysis of data collected during 200 test sessions in an experiment that examined localized aural cues compared to conventional non-localized methods in providing directional information in a visual acquisition task. Additionally HMOF was used to conduct several studies to determine how best to measure a subject's perception of the location of an auditory signal in three

Note: This was the end of the page there wasn't a page 2.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/01/90 | RRI Control Number : R07D013

Title:
Techniques and Applications for Binaural Sound Manipulation in HumanMachine Interfaces

Organization:
Name: Ames Research Center
Address:

, 0- 0

Point of Contact:
Name: Begault, Durand R. and Wenzel,
Phone #: 0

Source: NASA Technical Memorandum #102279

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Binaural sound technology for the development of auditory sound cues ("auditory icons") that could be applied to conflict alerts.

Summary:
Summary: The implementatin of binaural sound to speech and auditory sound cues ("auditory icons") is addressed from both an applications and technical standpoint. Techniques overviewed include processing by means of filtering with head-related transfer functions. Application to advancd cockpit human interface systems is discussed, although the techniques are extendable to any human-machine interface. Research issues pertaining to three-dimensional sound displays under investigation at the Aerospace Human Factors Division at NASA Ames Research Center are described.

Introduction: In normal hearing we use both ears, which allows important advantages in interacting with the environment. In spite of this, the auditory information in "high stress" human-machine interface contexts such as aviation is usually received over a monotic (one-ear) headset. It is surprising that, while advanced cab aircraft such as the McDonnell-Douglas MD-88 and the Boeing 767 incorporate highly sophisticated visual displays, cockpit auditory displays are largely a proliferatin of semantically unrelated warning sounds which take no advantage of the spatial information which plays so fundamental a role in everyday experience.

Research into improving the human-machine interface is partially motivated by giving attention to operator overload. For example, one source reports that at least 65% of jet transport accidents during 1977-1987 resulted from human errors (Hughes, 1989). One direction for improvement is to access perceptual systems other than vision for communicating important information to an operator. Because spatial hearing is a part of everyday experience that is important for both survival and orientation, it is sensible to determine how it can be manipulated for conveying information in a human-machine interface.

The types of binaural sound manipulation that are feasible to implement depend on the source of the signal. In an aircraft context, there are two distinct types of sources: (1) headphone speech communiction using radio transmissin originating from ground control or other aircraft, and (2) speech and warning signals that originate from the audio system installed in the cockpit.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 10/01/91 | RRI Control Number : R07G001

Title:
Signal And Listener Based Factors in Complex Auditory Pattern Perception Final Report 1 Oct (T)

Organization:
Name: Yale University
Address:

New Haven, CT 0- 0

Point of Contact:
Name: Arthur G. Samuel
Phone #: 0

Source: Star Vol. 30, No. 8, N92-17503

Availability Category: R | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Measurement of human perception patterns for speech and music interpretation. Applicable to aviation training programs.

Summary:
Signal And Listener Based Factors in Complex Auditory Pattern Perception Final Report, 1 Oct. 1990 - 30 Sept. 1991

The research conducted during the one year funding period was a subset of the original three year study of the perception of complex auditory patterns, including speech and music. One set of experiments explored two early stages in the perception of complex signals, using adaptation procedures. This research investigated effects of varying signal amplitude, and the effects of more cognitive factors: lexical knowledge, and the listeners level of attention to the adapting sound. A second set of experiments dealt with perceptual restoration effects. Those experiments investigated how knowledge of particular words influenced the perceptual restoration of deleted or degraded portions of the word. The two lines of research represent progress toward understanding the analyses conducted on complex auditory patterns by human listeners.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 07/01/91 | RRI Control Number : R07G003

Title:
The Matching of Doubly Ambiguous Stereograms

Organization:
Name: Mass. Inst. of Technology
Address:

Cambridge, MA 0- 0

Point of Contact:
Name: Daphna Weinshall
Phone #: 0

Source: Star Vol. 30, No. 5, N92-14587

Availability Category: M | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Algorithms that can be modified to letter display information under the constraints imposed by human perception will aid in developing improved controller displays.

Summary:
I have previously described psychological experiments that involved the perception of many transparent layers, corresponding to multiple matching, in doubly ambiguous random dot stereograms. Additional experiments are described in the first part of this paper. In one experiment, subjects were required to report the density of dots on each transparent layer. In another experiment, the minimal density of dots on each layer, which is required for the subjects to perceive it as a distinct transparent layer, was measured. The difficulties encountered by stereo matching algorithms, when applied to doubly ambigious stereograms are also described. Algorithms that can be modified to perform consistently with human perception, and the constraints imposed on their parameters by human perception, are discussed.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 01/01/92 | RRI Control Number : R07J003

Title:
Acquisition and Production of Skilled Behavior in Dynamic Decision-Making Tasks Semiannual (T)

Organization:
Name: Georgia Inst. of Technology
Address:

Atlanta, GA 0- 0

Point of Contact:
Name: Alex Kirlik
Phone #: 0

Source: Star Vol. 30, No. 8, N92-17132

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Relevancy on machine display enhancement and intellegent decision aids for improving human-machine interface.

Summary:
Acquisition and Production of Skilled Behavior in Dynamic Decision-Making Tasks Semiannual Status Report

Currently, two main approaches exist for improving the human-machine interface component of a system in order to improve overall system performance - display enhancement and intelligent decision making. Discussed here are the characteristics issues of these two decision-making strategies. Differences in expert and novice decision-making are described in order to help determine whether a particular strategy may be better for a particular type of user. Research is outlined to compare and contrast the two technologies as well as to examine the interaction effects introduced by the different skill levels and the different methods for training operators.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L002

Title:
The Effects of Speech Intelligibility Level on Concurrent Visual Task Performance Final Report

Organization:	Point of Contact:
Name: Human Engineering Labs	Name: See Summary
Address:	Phone #: 0
deen, MD 0- 0	Source: Star Vol. 30, No. 8, N92-17052

Availability Category: R	CR1-	CR2-	CR3-	CR4-

Relevancy:
Study of effects of speech intelligibility on decision-making is applicable to design of communications systems.

Summary:
David G. Payne, Leslie J. Peters, Deborah P. Birkmire, and Georges R. Garinther

Two experiments were performed to determine if changes in speech intelligibility level can impact performance levels in concurrent visual tasks. The auditory task used in both experiments was the auditory memory search task in which subjects memorized a set of words and then decided whether auditorally presented probe items were members of the memorized set. Experiment 1 uses an unstable tracking task as the visual task, and experiment 2 used a spatial decision-making task. Results showed that unstable tracking performance was unaffected by the level of speech intelligibility during auditory task, whereas accuracy in the spatial decision-making task was significantly worse at low speech intellibility levels. These results have clear implications for the design of communication systems. The findings are interpreted within the framework of multiple resource theory, and future directions for research are described.

See Also:

DECISION-MAKING

RRI Control Number	Title
R07A007	A Space-Time Neural Network for Processing Both Spacial and Temporal Data
R07A009	Decision Making in a Task Environment: The Effect of Time Pressure
R07A010	Elements of Theory of Natural Decision Making
R07A011	A Cogitative Model for Training Decision Making in Aircrews
R07A012	Cockpit Decision Making
R07A013	How Expert Pilots Think
R07A014	Proposed Action Plan to Improve ADM Effectiveness
R07A991	Workshop on Aeronautical Decision Making (ADM)
R07C002	Propagation-Based Decision Aids in the U.S. Navy
R07C007	Investigations of Naturalistic Decision Making and the Recognition Primed Decision Model
R07C009	Expert Pilot Decision-Making Models
R07C010	Distributed Decision-Making in a Dynamic Network Environment
R07C011	The Integrated Decision Modeling System (IDMS) User's Manual
R07M001	Acquisition and Production of Skilled Behavior in Dynamic Decision-Making Tasks

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 12/26/91 | RRI Control Number : R07A007

Title:
A Space-Time Neural Network for Processing Both Special and Temporal Data

Organization:
Name: NASA. Lyndon B. Johnson Space Center
Address:

Houston, TX 0- 0

Point of Contact:
Name: James A. Villarreal, et. al.
Phone #: 0

Source: STAR Vol. 30, No. 21, p. 3700

Availability Category: D | | CR1- | CR2- | CR3- | CR4-

Relevancy:
The technique of how a space-time neural network can process spatial as well as temporal data is being presented in this paper. Such technique can be applied to future FAA project.

Summary:
Neural networks are computing systems modeled after the paradigm of the biological brain. For years, researchers using various forms of neural networks have attempted to model the brain's information processing and decision-making capabilities. Neural network algorithms have impressively demonstrated the capability of modeling spatial information. On the other hand, the application of parallel distributed models to the processing of temporal data has been severely restricted. The invention introduces a novel technique which adds the dimension of time to the weell known back-propagation neural network algorithm. In the space-tiem neural network disclosed herein, the synaptic weights between two artificial neurons (processing elements) are replaced with an adapable-adjustable filter. Instead of a single synaptic weight, the invention provides a plurality of weights representing not only association, but also temporatl dependencies. In this case, the synaptic weights are the coefficients to the adaptable digital filters. Novelty is believed to lie in the disclosure of a processing element and a network of the processing elements which are capable of processing temporal as well as special data.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 01/23/92 | RRI Control Number : R07A009

Title:
DECISION MAKING IN A DYNAMIC TASK ENVIRONMENT: THE EFFECT OF TIME PRESSURE

Organization:
Name: Institute for Perception RVO-TNO
Address:
Soesterberg, 0- 0

Point of Contact:
Name: J.H. Kerstholt
Phone #: 0

Source: Star V31/N4, N93-14602

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
This report describes experimental results of the effects of time pressure on descision-making in a dynamic task environment (such as air traffic control). For the task environment used in this experiment, although information processing increased with time pressure, performance deteriorated. Data from experiemnts such as this can aid the FAA in better understanding controller performance under increasing time presssure.

Summary:
Two experiments were conducted to investigate time pressure effects on both the selected decision strategy and the quality of task performance. A dynamic task environment was used. Subjects were required to monitor the continuously changing fitness level of an athlete, and to recover the athlete whenever fitness decline had a physiological cause. Time pressure was defined by the rate at which the fitness level changed over time. The major decision problem of the subjects was to trade-off the costs of requesting information against the increasing risk of a costly consequence. The experiments differed in the incentive scheme that was used: in the first experiment, the subjects increased their chance on a bonus by saving time, whereas in the second experiment they could directly save on money. Both experiments showed a speed-up of information processing as time pressure increased. In the first experiment, subjects started to request information at the saw fitness levels in all time pressure conditions, whereas in the second experiment subjects started to request information at higher fitness levels when time pressure increased. However, in both experiments performance equally deteriorated under time pressure, as indicated by the number of athlete collapses. It is concluded that even though the subjects changed their strategy, and increased their speed of information processing under time pressure, performance declined more than predicted by time constraints alone. This extra effect is ascribed to the characteristics of the task environment.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/92	RRI Control Number : R07A010

Title:
ELEMENTS OF THEORY OF NATURAL DECISION MAKING

Organization:	Point of Contact:
Name: Honeywell Inc.	Name: John R. Bloomfield
Address:	Phone #: 0
Minneapolis, MN 0- 0	Source: Star V31/N4, N93-15021

Availability Category: R	CR1-	CR2-	CR3-	CR4-

Relevancy:
This report presents a new theory of natural decision-making. This particular theory includes complex real-world situations (such as air traffic control), involving proficient decision-makers (such as controllers).

Summary:
The preliminary theory provides a framework that can incorporate a broad range of decisions and decision situations ranging from the tightly-defined situations investigated by classical decision theorists all the way to complex real-world situations, involving proficient decision-makers, under a great deal of stress, and/or time pressure.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/92	RRI Control Number : R07A011

Title:
A COGNITIVE MODEL FOR TRAINING DECISION MAKING IN AIRCREWS

Organization:	Point of Contact:
Name: Klein Associates, Inc.	Name: Gary Klein
Address:	Phone #: 0
Fairborn, OH 0- 0	Source: Star V31/N4, N93-15020

Availability Category: M	CR1-	CR2-	CR3-	CR4-

Relevancy:
This report describes a cognitive model for training aircews in decision making. This cognitive model could be modified to provide training decision making for air traffic controllers.

Summary:
The topics addressed are: (1) prescriptions for effective decision making; (2) Recognition-Primed Decision (RPD) model; (3) key features of RPD model; (4) factors affecting the use of recognitional and analytical decisions; (5) team research and observations; (6) aspects of teamwork; (7) cognitive process of teams; (8) advanced team decision making - a development model; (9) key features and critical processes of decison making teams; (10) myths about team decision making; and (11) recommendations for team decision training.

See Also:

Date of Printout: 01/13/9

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/92	RRI Control Number : R07A012

Title:
COCKPIT DECISION MAKING

Organization:	Point of Contact:
Name: Air Force Inspection and Safety Center	Name: Alan Diehl
Address:	Phone #: 0
Norton AFB, CA 0- 0	Source: Star V31/N4, N93-15015

Availability Category: M		CR1-	CR2-	CR3-	CR4-	

Relevancy:
This report presents the results of six evaluations of aircrew decision making training. It shows that this training can help reduce aicrew errors (such as flap position on takeoff) and thereby prevent accidents. While the results of this evaluation are not surprizing, studies such as this can help the FAA in setting standards and requirements for airlines to conduct this type of training.

Summary:
The categorical distinctions between Cockpit Resource Management (CRM) and Aeronautical Decision Making (ADM) training are becoming blurred. Most current versions of these programs have five common elements which deal with attention, crew, stress, attitude, and risk management issues. The results of six empirical and six operational evaluations provide strong evidence that these training programs can help reduce aircrew errors and thereby prevent accidents. While additional research and development continues, there is a growing realization that these programs ideally need to be introduced early in flight training, reinforced during upgrade training, and reviewed during recurrent training and accident prevention sessions.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/92	RRI Control Number : R07A013

Title:
How Expert Pilots Think

Organization:	Point of Contact:
Name: Advanced Aviation Concepts	Name: Richard Adams
Address:	Phone #: 0
Jupiter, FL 0- 0	Source: Star V31/N4

Availability Category: M	CR1-	CR2-	CR3-	CR4-

Relevancy:
This report provides an overview of current cognitive psychology's understanding of the cognitive processes associated with expertise. Understanding how to develop expertise in pilots and controllers during training will enhance performance and reduce human error accidents.

Summary:
This paper provides an overview of the conceptual cognitive psychology research that defines and delineates the important characteristics of expertise. It is hoped that the understanding of the cognitive processes associated with experts will increase the awareness of these processes in the pilot training community. The importance of the attainment of a higher level of cognitive skills by pilots is the opportunity to enhance performance and further reduce human error accidents through improved decision making training.

See Also:
"Training Considerations for Expert Pilot Decision Making" (Adams, R.J. and Lofaro, R.J., 1992). 1992 Collegiate Aviation Review.

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/01/92 | RRI Control Number : R07A014

Title:
PROPOSED ACTION PLAN TO IMPROVE ADM EFFECTIVENESS, PART 3: DEVELOPING A NEW ADM (SEE SUMMARY)

Organization:
Name: Advanced Aviation Concepts
Address:

Jupiter, FL 0- 0

Point of Contact:
Name:
Phone #: 0

Source: Star V31/N4, N93-15026

Availability Category: M | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
This report will provide the aviation industry and the FAA with a roadmap to assist in the development of improved aeronautical decision making (ADM) concepts and training methods.

Summary:
Proposed Action Plan to Improve AFM Effectiveness, Part 3: Developing a New ADM Paradigm on Which to Build Advanced or Expert Decision Making Training

Aeronautical Decision Making (ADM) training benefits in terms of reducing human error accident rates were documented during the presentations at the workshop. Basic research needs, training implementation problems and the need for additional modeling work were also identified. This document provides the aviation industry and the FAA with a suggested roadmap to assist in the development of improved ADM concepts and training methods. The basic questions that will be addressed are: (1) Can decision making tasks be identified and defined? (2) What are the training objectives? (3) What are the appropriate training strategies?; and (4) How can the training effectiveness be evaluated?

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 08/01/92	RRI Control Number : R07A991

Title:
Workshop on Aeronautical Decision Making (ADM)

Organization:	Point of Contact:
Name: Advanced Aviation Concepts, Inc. (AAC)	Name: see summary
Address: Jupiter, FL; FAA Research and Developmen t Service, Washington, DC , 0- 0	Phone #: 0
	Source: NTIS DOT/FAA Report RD-92/14 Vols I, II

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
A team of cognitive experts conducted research toward the future enhancement of flight crew training (airplanes & helicopters) in the area of Aeronautical Decision Making (ADM)

Summary:
Ronald John Lofaro, Ph.D. (FAA); Richard J. Adams (AAC); Catherine A. Adams (AAC)

This report presents Aeronautical Decision Making (ADM) training accomplishments, limitations and future needs from the perspectives of commercial operators, general aviation, military aviation and research - development. A select group of experts on ADM was convened to share ideas, identify and explore future directions for advanced training. Cognitive training requirements based upon decision making task demands of both airplane and helicopter pilots and crews are analyzed. A major question which requires definitional research is: "What is a real aircrew/pilot decision?" -- that is, when does an event generate a true decisional opportunity for a pilot or crew versus a "one-path only" reaction, where the actual emphasis is not on cognitive decision making, but the application of procedures and basic airmanship. Going one step further, the group analyzed the decision making differences between expert and novice pilots when a real decision was required.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/89 | RRI Control Number : R07C002

Title:
Propagation-Based Decision Aids in the U.S. Navy

Organization:
Name: Naval Ocean Systems Center
Address:

San Diego, CA, 0- 0

Point of Contact:
Name: Paulus, R. A.
Phone #: 0

Source: NTIS, 1442513 N90-14410/6/XAB

Availability Category: 0 | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Application of an existing tactical decision and technology to other command & control systems is explored.

Summary:
The U. S. Navy was using a shipboard radar propagation assessment system for the past decade. This system was conceived as the integrated Refractive Effects Prediction System (IREPS) in 1973; tested at sea in 1976; and installed on most capital ships beginninig in 1978. IREPS provided two types of products: displays of refractivity data and sensor performance displays. The workhorse display was the radar coverage diagram used by the air wing to determine penetration of jamming altitudes against hostile radars. This initial capability to exploit propagation effects was received so enthusiastically and proved so successful that the development of Tactical Decision Aids (TDAs) became part of an ongoing program to enhance this capability in the fleet. These TDAs structure the propagation information for the decision maker and perform functions that would otherwise overwhelm him. The decision maker is not directed to a specific course of action but rather is provided a framework within which tradeoff decisions can be made with respect to propagation in conjunction with other essential factors o. the mission. This approach to the development of an aircraft stationing aid is discussed along with an overview of several TDAs applicable to various warfare areas. Efforts to incorporate these tactical decisions aids into Navy sea-based command and control systems are explored.

Descriptors: *Command and control; *Decision making; *Prediction analysis techniques; *Radar echoes; *Tactics; Warfare; Wave propagation; Antenna radiation patterns; Display devices; Jamming; Navy; Refractivity.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 07/01/90 | RRI Control Number : R07C007

Title:
Investigations of Naturalistic Decision Making and the Recognition Primed Decisiion Model

Organization:
Name: Klein Associates
Address:

Yellow Springs,, 0- 0

Point of Contact:
Name: Klein, Gary A. & Calderwood, R
Phone #: 0

Source: STAR N91-13351, Vol. 29, page 602

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Describes the development of a recognitions primed decision model that has applications to military command and control decision making.

Summary:
This monograph reviews three years of research that explores how experienced personnel make decisions in operational settings characterized by real-time information processing, shifting goals, and high-risk consequences. The study combined field studies with experiments designed to test specific hypotheses. Study domains were selected so that findings would have high potential for genealizing to military command-and-control decision making. Researchers carried out critical decision interviews with experienced personnel, including urban fire ground commanders, wildland fire incident commanders, and U.S. Army tank platoon leaders. Interviews were designed to elicit information about the cues, goals, and option evaluation strategies used by these personnel. Based on these interviews, the relationships among such factors as time pressure, experience level, and group interactions were explored. The results of these studies have been used to develop a recognition-primed decision (RPD) model of decision making. This model contrasts with current normative and prescriptive models of decision making, and the implications of this alternative framework are explored.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 10/01/90 | RRI Control Number : R07C009

Title:
Expert Pilot Decision-Making Models

Organization:
Name: AF Human Resources Lab.
Address:
Brooks AFB, TX, 0- 0

Point of Contact:
Name: Thurman, R. A.
Phone #: 602

Source: DTIC

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Expert pilot decision making model employing neural network technology that could be applied to automation terminal airspace mgmt.

Summary:
Objective: (U) To develop an expert system representing optimal decision making processes in air-to-air combat maneuvering.

Approach: (U) An artificially intelligent model will be developed which will discriminate among potential series of tactical maneuvers based upon initial relative state and desired end state of two opposing fighter aircraft.

Progress: (U) Startdate-01-Jan-90 endate-30-Jun-90 during this period. Development of the neural network was completed and successfully applied to several domains. The first application focused on a model of air combat maneuvering (ACM) decision-making based on selection of basic fighter maneuvers. In previous efforts a production system had been developed and found to correctly predict instructor pilot (IP) selections 25% of the time. A neural net was trained which enabled accurate predictions of G-loading. The third application focused on the adaptive maneuvering logic (AML), which is a computerized adversary model that is currently used in the SAAC. A neural net was successfully trained to produce outputs consistent with the AML. Efforts are underway to explore the feasibility of using neural nets to predict engagement outcomes during air combat. An experiemnt is also planned to gather controlled association data for a sample of pilots and attempt to relate the resulting conceptual structures to proficiency in air combat.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 01/01/90	RRI Control Number : R07C010

Title:
Distributed Decision Making in a Dynamic Network Environment

Organization:	Point of Contact:
Name: Rockwell International	Name: Sastry, A. R.; Baker, J. E.; C
Address:	Phone #: 0
Thousand Oaks,, 0- 0	Source: NTIS l444596 AD-A217 410/0/XAB

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Decision making aids and multisensor data fusion are required technologie for designing an automated future ATC system.

Summary:
This report is concerned with distributed tactical decision making (DTDM) in a command and control system using geographically dispersed communicatin networks. We carried out the following investigations with the underlying motivation to model an integrated decision making environment that captures the essential real-time interactions among communications, data fusion, and decision making. Keywords Value-based protocals; Multissensor data fusion: Dynamic organizational rationality and group effectiveness.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 05/01/91	RRI Control Number : R07C011

Title:
The Integrated Decision Modeling System (IDMS) User's Manual

Organization:	Point of Contact:
Name: Metrica, Inc.	Name: Jonathan C. Fast
Address:	Phone #: 0
San Antonio, TX 0- 0	Source: STAR Vol. 29, No. 22, p. 3726

Availability Category: R		CR1-	CR2-	CR3-	CR4-

Relevancy:
Using intelligent user interface to assist system analysis and decision making process is a promising approach for future applications in A.I.

Summary:
The Integrated Decision Modeling System (DMS) is a prototype computer based decision aid which incorporates a user interface to help the decision maker analyze a problem, determine the most appropriate decision aiding tool, and utilize the selected tool. Each of the four decision aiding models as well as the user interface and sensitivity analysis modules are presented in appendices which discuss the technique, provide examples of their use, and instruct the user as to how to access each through the computer.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07M001

Title:
Acquisition and Production of Skilled Behavior In Dynamic Decision-Making Tasks: Modeling (T)

Organization:	Point of Contact:
Name: Georgia Inst. of Tech	Name: Alex Kirlik
Address:	Phone #: 0
Atlanta, GA 0- 0	Source: Star Vol. 30, No. 4, N92-13576

Availability Category: R		CR1-	CR2-	CR3-	CR4-

Relevancy:
Use of modeling and labratory experiments to develop optimum automation-aid strategies for flight crews.

Summary:
Acquisition and Production of Skilled Behavior In Dynamic Decision-Making Tasks: Modeling Strategic Behavior in Human-Automation Interaction: Why and Aid Can (And Should) Go Unused Semiannual Status Report

Advances in computer and control technology offer the opportunity for task-offload aiding in human-machine systems. A task-offload aid (e.g., and autopilot, an intelligent assistant) can be selectively engaged by the human operator to dynamically delegate tasks to an automated system. Successful design and performance prediction in such systems requires knowledge of the factors influencing the strategy the operator develops and uses for managing interaction with the task-offload aid. A model is presented that shows how such strategies can be predicted as a function of three task context properties (frequency and duration of secondary tasks and costs of delaying secondary tasks) and three aid design properties (aid management and disengagement times, aid performance relative to human performance). Sensitivity analysis indicates how each of these contextual and design factors affect the optimal aid aid usuage strategy and attainable system performance. The model is applied to understanding human-automation interaction in laboratory experiments on human supervisory control behavior. The laboratory task allowed subjects freedom to determine strategies for using an autopilot in a dynamic, multi-task environment. Modeling results suggested that many subjects may indeed have been acting appropriately by not using the autopilot in the way its designers intended. Although autopilot function was technically sound, this aid was not designed with due regard to the overall task context in which it was placed. These results demonstrate the need for additional research on well as those provided by automation, in an effort to keep workload and performance at acceptable levels.

See Also:

PERFORMANCE

RRI Control Number	Title
R07A992	Workshop on Integrated Crew Resource Management
R07L001	A New Test of Scanning and Monitoring Ability: Methods and Initial Results
R07L006	Psychiatric Disorders in Aerospace Medicine: Signs, Symptoms, and Disposition
R07L007	Psychological Factors Influencing Performance and Aviation Safety
R07L009	Domestic Problems and Aviator Family Support
R07L010	Psychometric Evaluation Techniques in Aerospace Medicine
R07L012	Psychiatric Reactions to Common Medications

Date of Printout: 03/04/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 05/01/92	RRI Control Number : R07A992

Title:
Workshop on Integrated Crew Resource Management (CRM)

Organization:	Point of Contact:
Name: FAA Research and Development Service	Name: Ronald John Lofaro, Ph.D.
Address:	Phone #: 0- 0
0- 0	Source: NTIS DOT/FAA Report: RD-92/5

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
An FAA study to develop an analytic paradigm to measure the effect on flight control skills from cockpit resource management (CRM) training.

Summary:
The main issues in doing a simultaneous and integrated assessment of CRM and flight control performance revolve around:

1. Identifying, developing and validating the observable/rateable perfomance behaviors that define CRM.

2. Developing a behaviorally-anchored scale, or set of scales by which to assess these CRM performance behaviors. There is also the problem of developing a set of crew performance behaviors for the technical flight control skills similar in format to the CRM performance markers; this set would then be used in any attempt at the integration with the CRM behaviors.

3. Developing an analytic paradigm which could both identify and demonstrate (what were) the CRM performance behaviors embedded in, and intrinsic to, the flight control skills necessary for safe, efficient missions. Such a paradigm must be able to analytically show where the integration of CRM and flight control skills occurred, i.e., where during the accomplishment of which maneuvers/tasks/sub-tasks. The model should be capable of dealing, on a specific level, not only with different aircraft types, but also with different environmental conditions and with the different SOP's in use with the different air carriers.

4. Finally, any model or paradigm developed needed to be both operationally-oriented and very accurate. This is because any CRM integration paradigm would immediately confront a mind-set that has evolved in the development and "selling" of CRM and from the idea of the existence of "soft" (as opposed to "hard") piloting skills.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 03/01/92 | RRI Control Number : R07L001

Title:
A NEW TEST OF SCANNING AND MONITORING ABILITY: METHODS AND INITIAL RESULTS

Organization:
Name: FAA, Office of Aviation Medicine
Address: Wash, DC

, 0- 0

Point of Contact:
Name: A.M. Revzin, P.G. Rasmussen
Phone #: 0

Source: DTIC T84536 p3

Availability Category: | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Analysis of air traffic controllers' performance and error patterns while working at a radar screen.

Summary:
Most tasks in the FAA's Air Traffic Control (ATC) system involve long duration scanning and monitoring for continuously changing events occurring within a large visual space. Errors occur, so it is important to understand the causes of such errors to minimize or eliminate them by changing task design or improving personnel selection. This study describes a new system for testing scanning and monitoring abilities. The system, as currently implemented, is basically a character identification task. The characters are presented at random intervals and locations within two or more WorkAreas. The WorkAreas are defined as rectangular areas on a microcomputer display screen. They are filled with a constantly changing random dot pattern and may be located anywhere on the screen. The subject's task is to press a designated key on the computer keypad when a specified target character appears. Parametric manipulations can evaluate the effects on performance of many variables, including angular separation of WorkAreas, differential workloads in the WorkAreas, and effects of visual noise. We found a highly significant performance decrement as a function of increasing angular separation of WorkAreas. This is congruent with prior studies, which we interpret as a validation of our test procedure. We did not find practice effects, fatigue effects, or selective attention effects between WorkAreas.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/91 | RRI Control Number : R07L006

Title:
Psychiatric Disorders in Aerospace Medicine: Signs, Symptoms, and Disposition

Organization:
Name: Jones (David R.)
Address:

San Antonio, TX 0- 0

Point of Contact:
Name: David R. Jones
Phone #: 0

Source: Star Vol. 30, No.4, N92-13551

Availability Category: N | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Signs of psychiatric problems with aviators. Improved understanding contributes to aviation safety.

Summary:
The major categories of psychiatric diagnosis and how a few that are more commonly seen in aviators may affect flying duties are considered. Major psychotic disorders are always disqualifying, as are affective disorders, manic depressive. Lesser depressive disorders may not be so, depending on the depth of symptoms, the reaction of the flyer, and his/her insight into the condition. Neurotic disorders may or may not require grounding, again depending on the degree of symptoms. Organic mental disorders are generally cause for permanent grounding, unless the cause is reversible and not likely to occur again (e.g. acute toxic reactions). Personality disorders are always troublesome, and are likely to be handled through administrative rather that medical channels. The general symptoms involved in these disorders are discussed in a later presentation. Psychiatric disorders are frequently underdiagnosed, both because operational personnel may not recognize these ailments for what they are and because of the tendency of some non-flying psychiatrists and psychologists to shield the flier from grounding by not accurately diagnosing what they see; by avoiding its proper name. This dangerous practice may allow possible dysfunctional fliers to fly, and deny them adequate treatment, specifically, medications.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L007

Title:
Psychological Factors Influencing Performance and Aviation Safety

Organization:	Point of Contact:
Name: Letterman Army Inst. of Research	Name: James J. Picano
Address:	Phone #: 0
San Francisco, CA 0- 0	Source: Star Vol. 30, No. 4, N92-13552

Availability Category: 0	CR1-	CR2-	CR3-	CR4-

Relevancy:
Safety-related performance of aviators from a psychological perspective.

Summary:
Two major ppsychological factors which can adversely affect health, flight performance, and decision making in aviation personal are discussed: stress and hazardous thought patterns. A model for understanding stress and appraising its effects on human performance in aviation is presented. Understanding the effects of stress on health and performance is essential to designing and implementing proactive preventive programs aimed at promoting and preserving the health and welfare of pilots and enhancing aviation safety.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L009

Title:
Domestic Problems and Aviator Family Support

Organization:	Point of Contact:
Name: Institute of Aviation Medicine	Name: Grete Myhre
Address:	Phone #: 0
Oslo, Norway, 0- 0	Source: Star Vol. 30, No. 4, N92-13555

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Impact of personal problems and family support on aviator performance and safety.

Summary:
The usefulness of wives squadron groups in helping the wives of military pilots deal with their unique family situations is discussed. General psychology in relation to crisis situations is discussed, especially dealing with the feelings of grieving, loss, and mourning following an accident. Case studies are presented.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L010

Title:
Psychometric Evalution Techniques in Aerospace Medicine

Organization:	Point of Contact:
Name: School of Aerospace Medicine	Name: John C. Patterson
Address:	Phone #: 0
Brooks, AFB, TX G- 0	Source: Star Vol. 30, No. 6, N92-13557

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Use of clinical review and psychological testing to determine flight crewmember's readiness to fly.

Summary:
The role of psychometric evaluation techniques in aerospace medicine is discussed, with emphasis on the use of psychological evaluation in making the decision of whether a pilot should return to flying after an illness. Aspects of the clinical review and psychological testing are discussed. It is argued that psychological testing should result in relevant recommendations about flying status based on the examiners experience and the specific evaluation of the aviator.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L012

Title:
Psychiatric Reactions to Common Medications

Organization:	Point of Contact:
Name: David Jones	Name: David R. Jones
Address:	Phone #: 0
San Antonio, TX 0- 0	Source: Star Vol. 30, No. 4, N92-13559

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Safety-oriented analysis of effects of medication on flying personnel.

Summary:
The somatic effects of most non-prescription medications that are available to pilots usually well-known to flight surgeons, but some of the effects on mental processes may not be as well understood. Some of these are reviewed. Trifluoperazine, daizepam, chlordiazepoxide, flurazepam, triazolam, and temazepam are discussed.

See Also:

AUTOMATION/ARTIFICIAL INTELLIGENCE

RRI Control Number	Title
R07A993	The Development of Enhanced Screening Techniques for the Selection of ATC Personnel
R07C006	Operator Function Modeling: Cognitive Task Analysis, Modeling and Intelligent Aiding in Supervisory Control Systems
R07H001	Adaptive Function Allocation for Intelligent Cockpits
R07H004	The Human-Electronic Crew: Is the Team Maturing?
R07J001	Human-Computer Interface Design for Intelligent Systems
R07J004	USI Rapid Prototyping Tool Evaluation Survey
R07L025	Identifying Ability Requirements for Operators of Future Automated Air Traffic Control Systems
R07Z005	Designing Human Centered Systems: Circa 2039 Scenario
R07Z014	NASA Human Factors Programmatic Overview
R07Z023	Institute for the Study of Human Capabilities
R07Z027	The Human Factor in Aerospace Maintenance

Date of Printout: 03/04/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/30/91 | RRI Control Number : R07A993

Title:
The Development of Enhanced Screening Techniques for the Selection of ATC Personnel

Organization:
Name: Embry-Riddle Aeronautical Univ./ FAA
Address:

0- 0

Point of Contact:
Name: see summary
Phone #: 0- 0

Source: 1991 ATCA Proceedings

Availability Category: M | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
In response to the attrition rates (up to 40 percent) for Air Traffic Control Specialist (ATCS) candidates, this research effort was conducted to aid in the development of enhanced selection procedures that will identify potential attrites before their entry into the FAA Academy or field training programs.

Summary:
Embry-Riddle Aeronautical Univ. - Gerald D. Gibb, Marvin L. Smith, Neil Swindells, David Tyson, Michael J. Gieraltowski, Kenneth W. Petschauer, Richard S. Walsh

FAA, Wash. D.C. - Ronald J. Lofaro

This analysis was conducted by a team of research investigators in response to the problem of consistently high attrition rates (as high as 40 percent) among Air Traffic Control Specialist (ATCS) candidates at the FAA Academy and during field training. The objective of the research was to facilitate the development of a systematic approach to identifying the critical skills and abilities required of ATCS candidates in both the training and operational environments. The ultimate goal is the development of enhanced selection procedures that can reliably identify potential attrites before their entrance into the Academy or field training programs. Through task analysis of the nonradar screen environment, the research team identified 18 cognitive-sensory attributes that appear critical for succussful problem solving and overall air traffic management. In addition to necessary attributes for on-the-job performance, the research team recommended the further development of instruments that are valid predictors of academic performance during ATC training. Althogh this analysis did not consider biographical factors or personality traits (other than decisiveness), these issues were judged by the research team to warrant continued investigation.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/90 | RRI Control Number : R07C006

Title:
Opertr Fnctn Modeling: Cognitive Task Anlys, Modeling and Intelgnt Aiding in Spvisoy Ctl Sys

Organization:
Name: Georgia Inst. of Tech.
Address:
Atlanta, GA, 0- 0

Point of Contact:
Mitchell, Christine M.
Phone #: 0

Source: STAR, N91-11380, Vol. 29, page 248

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Discusses design of a task analytic model and intelligent decision aid for operators of command and control systems.

Summary:
The design, implementation, and empirical evaluation of task-analytic models and intelligent aids for operators in the control of complex dynamic systems, specifically aerospace systems, are studied. Three related activities are included: (1) the models of operator decision making in complex and predominantly automated space systems were used and developed: (2) the Operator Function Model (OFM) was used to represent operator activities; and (3) Operator Function Model Expert System (OFMspert), a stand-alone knowledge-based system was developed, that interacts with a human operator in a manner similar to a human assistant in the control of aerospace systems. OFMspert is an architecture for an operator's assistant that uses the OFM as its system and operator knowledge base and a blackboard paradigm of problem solving to dynamically generate expectations about upcoming operator activities and interpreting actual operator actions. An experiment validated the OFMspert;s intent inferencing capability and showed that it inferred the intentions of operators in ways comparable to both a numan expert and operators themselves. OFMspert was also augmented with control capabilities. An interface allowed the operator to interact with OFMspert, delegating as much or as little control responsibility as the operator chose. With its design based on the OFM, OFMspert's control capabilities were available at multiple levels of obstraction and allowed the operator a good deal of discretion over the amount and level of delegated control. An experiment showed that overall system performance was comparable for teams consisting of two human operators with a human operator and OFMspert team.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 01/01/91	RRI Control Number : R07H001

Title:
ADAPTIVE FUNCTION ALLOCATION FOR INTELLIGENT COCKPITS

Organization:
Name: Naval Air Development Center
Address: Air Vehicle and Crew Systems Tech. Dept.
Warminster, PA
, 0- 0

Point of Contact:
Name: J. Morrison, J. Gluckman
Phone #: 0

Source: DTIC T89532 p2

Availability Category: | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Cockpit automation studies. Specific human tasks defined for possible automation.

Summary:
The demands associated with flying modern tactical, strategic and commercial aircraft have made the cockpit a prime arena for the development of technology designed to aid human operators. The development of ever more powerful computers, expert systems, and artificial intelligence technology has led researchers and system designers to propose that decision making by aided dynamically using this technology. The implementation of this technology may modify the tasks normally performed by pilots in any of a number of ways, in order to facilitate the best performance of man machine systems. A series of Cockpit Automation Studies are being performed as part of the Adaptive Function Allocation for Intelligent Cockpits program. The goal of the program is to develop a prospective set of human performance based principles and guidelines for the application of adaptive automation technology. As the first study this research developed a basic set of tasks in which automation concepts could later be applied. Derivatives of two common laboratory tasks were used: one task was a pursuit tracking task while the other task was a tactical assessment task (TAT). Subject's response time and accuracy were measured on the TAT while root mean square errors were obtained on the tracking task. Simple and complex task performance was measured as a function of task difficulty. Simple task results generally supported a resource view of human performance.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 07/01/92	RRI Control Number : R07N004

Title:
THE HUMAN-ELECTRONIC CREW: IS THE TEAM MATURING? THE 2ND JOINT GAF/RAF/USAFk (SEE SUMMARY)

Organization:	Point of Contact:
Name: Wright Lab	Name: See Summary
Address:	Phone #: 0
Wright Patt AFB, OH 0- 0	Source: Star V31/N4, N93-14520

Availability Category: D		CR1-	CR2-	CR3-	CR4-

Relevancy:
This report describes the results of a workshop to discuss the application of artificial intelligence to the cockpit to assist the aircrew and what impact automation will have on aircrew procedures.

Summary:
The Human Electronic Crew: Is the Team Maturing? The 2nd Joint GAF/RAF/USAF Workshop on Human Electronic Crew Teamwork

Terry Emerson, Michael Reinecke, John Reising, and Robert Taylor

Advances in artificial intelligence (AI) will enable future fighter/attack aircraft to have a rather unique crew -- one human and one electronic. The objective of the workshop was to bring together AI specialists, aircrew, and cockpit designers in order to exchange ideas relative to (1) the state of the art in aircraft applications AI technology and (2) the impact on cockpit of the human/electronic crew. This meeting provided valuable forum for the experts of several countries to exchange ideas, concepts, adn data relative to hardware and software capabilities that can be included in an aircraft systems design to aid the human operator in performing the mission.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/91 | RRI Control Number : R07J001

Title:
Human-Computer Interface Design for Intelligent Systems (t)

Organization:
Name: NASA, Johnson Space Center
Address:

Houston, TX 0- 0

Point of Contact:
Name: Jane T. Malin, (t)
Phone #: 0

Source: STAR Vol. 29, No. 22, p.3722

Availability Category: M | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Designing more effective Human-Computer Interfaces for intelligent systems with real-time fault management capabilities could provide for improvements to air traffic systems such as the developing AAS/VSCS projects.

Summary:
Full title: "Making Intelligent Systems Team Players: Case Studies and Design Issues. Vol. 1: Human-Computer Interaction Design"
Full POC names: Jane T. Malin, Debra L. Schreckenghost, David D. Woods, Scott S. Potter, Leila Johannesen, Matthew Holloway, and Kenneth D. Forbus
Initial results are reported from a multi-year, interdisciplinary effort to provide guidance and assistance for designers of intelligent systems and their user interfaces. The objective is to achieve more effective human-computer interaction (HCI) for systems with real time fault management capabilities. Intelligent fault management systems within the NASA were evaluated for insight into the design of systems with complex HCI. Preliminary results include: (1) a description of real time fault management in aerospace domains; (2) recommendations and examples for improving intelligent systems design and user interface design; (3) identification of issues requiring further research; and (4) recommendations for a development methodology integrating HCI design into intelligent system design.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07J004

Title:
USI Rapid Prototyping Tool Evaluations Survey

Organization:	Point of Contact:
Name: Mitre Corp	Name: Marian Murphy
Address:	Phone #: 0
Bedford, MA 0- 0	Source: Star Vol. 30, No.8, N92-17673

Availability Category: D	CR1-	CR2-	CR3-	CR4-

Relevancy:
Design and development of user interface for command and control systems has applications for controllers and flight crews.

Summary:
The Human Factors Engineering for User System Interface (HFE/USI) Speciality Group has conducted several evaluations of rapid prototyping tools to support the design and development of user interfaces for command and control systems. To standardize the evaluation methodology, we compiled a list of command and control criteria and rated tools against them. These ratings can be used to select a tool that will closely match the needs of a MITRE/ESD program. This paper describes the evaluation methodology and applies it to the review tools: VAPS, LUIS/SMS, SL-GMS, Data Views, TAE Plus, and SET.

See Also:

Date of Printout: 01/14/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/01/92 | RRI Control Number : R07L025

Title:
Identifying Ability Requirements for Operators of Future Automated Air Traffic Control Systems

Organization:
Name: Federal Aviation Administration
Address:

Washington, DC 0- 0

Point of Contact:
Name: Carol Manning, Dana Broach
Phone #: 0

Source: Star V31/N4, N93-14276

Availability Category: | | CR1- | CR2- | CR3- | CR4- |

Relevancy:

Summary:
This study was conducted to anticipate the impact on air traffic controller ability requirements that may result from implementation of a future stage of air traffic control automation. If important changes occur in ability requirements, it will be necessary to develop or modify selection procedures for future air traffic controllers. Accurate identification of ability requirements depends on knowledge of the job tasks to be performed, but only general information is currently available about the job tasks associated with later stages of air traffic control automation. In this study, nine air traffic controllers who had analyzed operational requirements for a future stage of automation described how controllers would perform four job tasks using the automation, assessed the degree to which nine specific abilities were likely to be required to perform the automated tasks, and assessed whether the amount of each ability required to perform the equivalent tasks in the current system. The controllers thought that some changes will occur in the presentation of information, much of the requirement for verbal coordination will be removed, and much of the detailed information that the controller must present will be supplanted by automation aids. At the same time, these controllers suggested that that the future controller will have to have about the same levels as required today of the abilities discussed in the study to perform the tasks included in the study.

See Also:

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/01/90 | RRI Control Number : R072005

Title:
Designing Human-Centered Systems: Circa 2039 Scenario

Organization:
Name: Air Force Human Resources Lab.
Address:

Brook AFB, TX, 0- 0

Point of Contact:
Name: Henry, Eugene H.
Phone #: 0

Source: STAR N91-12207, VOl. 29, page 397

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Development of a methodology, such as the AIRT, to measure the impact of automation on a system will greatly aid the design of automation into future ATC sytems.

Summary:
The advancement of technology has permitted the introductin of automation into a variety of military environments. Though automation offers new and increased cpabilities, issues exist concerning the operability of systems with automation. For example, what is the appropriate operator workload associated with using automated systems. To answer such questions, a new and board methodology is required. The Air Force Human Resources Laboratory (AFHRL) is presently conducting research to develop such a methodology, called the Automation Impacts Research Testbed (AIRT). A futuristic vision of a mature AIRT is provided along with how it can assist the design of automated systems. In relating this vision, the report is written as a story set in the twenty-first century. The story illustrates the operability concept through characters who describe examples of good and bad operability design. Additionally, the story includes a description of possible tools that might be usedd in the future to address operability concerns. The scenario ends by being linked to the research presently being conducted at FHRL.

See Also:

Date of Printout: 03/04/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 02/01/92	RRI Control Number : R072014

Title:
NASA Human factors Programmatic Overview

Organization:	Point of Contact:
Name: NASA Ames Research Center	Name: Mary M. Conners
Address:	Phone #: 0- 0
Moffett Field	
0- 0	Source: STAR Vol. 30, No. 13, p. 2235

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
The research about Human Computer Interaction (HCI) in pursuit of safety, productivity, and reliability has the similar goals as those of FAA.

Summary:
Human factors addresses humans in their active and interactive capacities, i.e., in the mental and physical activities that they perform and in the contributions they make to achieving the goals of the mission. The overall goal of space human factors in NASA is to support the safety, productivity, and reliability of both the on-board crew and the ground support staff. Safety and reliability are fundamental requirements that human factors shares with other disciplines, while productivity represents the defining contribution of the human factors discipline.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/31/92 | RRI Control Number : R07Z023

Title:
INSTITUTE FOR THE STUDY OF HUMAN CAPABILITIES

Organization:
Name: Indiana University
Address: Poplars Research and Conference Center

Bloomington, IN 0- 0

Point of Contact:
Name: Charles Watson
Phone #: 0

Source: Star V31/N4, N93-14427

Availability Category: R | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Describes work at the Institute for the Study of Human Capabilities in the areas of human error and human-computer interfaces.

Summary:
We continue to make significant progress toward our long-term goals. The Institute maintains an inter-laboratory, work-station based computer network. A third conference was held during this funding period, on March 25-27, 1992, again on the subject of Human Error. During the funding period, the university completed rehabilitation of three buildings for use in Institute-related research, Andrew Dillon, from the Human Sciences and Advanced Technology Research Institute in Loughborough, England, collaborated with several groups at the university of human-computer interactions. The institute has provided partial support of research leading to the publication, during the past year, of 46 journal articles and book chapters, and the presentatoin of 28 pages at meetings of scientific societies, described in this report.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 10/01/93	RRI Control Number : R072027

Title:
The Human Factor in Aerospace Maintenance

Organization:	Point of Contact:
Name: NASA's Johnson Space Flight Center	Name: F.E. Mount
Address:	Phone #: 0
, 0- 0	Source: Aerospace America, Oct. 93

Availability Category:		CR1-	CR2-	CR3-	CR4-	

Relevancy:

Summary:

Emerging technologies will pose growing maintenance challanges just when the number of skilled technicians is declining. Aerospace maintenance is a critical field that depends on the availability of highly trained personnel. These workers must develop skills that allow a minimum of errors and make the most efficient use of time, since many aerospace oeprations are costly and time-critical. The 21st century maintenance manager will be responsible for maintaining extremely complex and computer-intensive systems at a time when skilled workers are expected to be in short supply.

The result of this prelimary study was that the most significant barrier to entering the aviation field was lack of skills in math and science, not in English. Technology can be a major factor in determining how best to meld job and worker. In the 1980s much development work focused on meeting industry's expressed need for systems that require less technical support. Artificial intelligence, built-in test, integrated diagnostics, top-level maintenance, graceful degradation, total integration and automation of the design/development process, and concurrent engineering are being adopted to meet this need. Their overriding goal is to minimized cost-effectively the skill levels and man-hours required for the support of complex systems.

As rapid technological changes affect the field of aerospace maintenance, human factors will play an increasingly important role in ensuring overall vehicle safety. Only by preparing today to address the gap between demographics and emerging technologies will aerospace organizations be able to compete in the 21st century.

See Also:

AEROMEDICAL

RRI Control Number	Title
R07L003	Neurological, Psychiatric, and Physiological Aspects of Aerospace Medicine
R07L004	Introduction to Aerospace Neurology
R07L005	Aviation Psychology in the Operational Setting
R07L008	Unexplained Loss of Consciousness
R07L011	Psychological Factors Influencing Performance and Aviation Safety
R07L013	The Failing Aviator
R07L015	Medical or Administrative? Personality Disorders and Maladaptive Personality Traits

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L003

Title:
Neurological, Psychiatric and Psychological Aspects of Aerospace Medicine

Organization:	Point of Contact:
Name: Advisory Group for Aerospace Research and Develop	Name:
Address:	Phone #: 0
Neuilly-Sur-Sei, FR 0- 0	Source: Star Vol. 30, No. 4, N92-13547

Availability Category: M	CR1-	CR2-	CR3-	CR4-

Relevancy:
Neuropsychiatric studies of flight crew personnel for safety enhancement.

Summary:
An overview of the neurological, psychiatric, and psychological aspects of aerospace medicine is presented. The purpose is to further the knowledge of the flight surgeon and aeromedical examiner in the issues of neuropsychiatry. Aeromedical information is provided for the neuropsychiatric specialist. The unique application of psychiatry, psychology, and neurology to the aviation environment is described. Topics such as motivation to fly, human performance, stress in aviation, and systems engineering analysis; an ECLSS cost/benefit analysis to identify rack-level interface requirements of the alternate technologies evaluated in the ventilation study, with a comparison of these with the rack level interface requirements for the baseline technologies; advanced instrumentation - technology database enhancement;

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L004

Title:
Introduction to Aerospace Neurology

Organization:	Point of Contact:
Name: School of Aerospace Medicine	Name: Marc S. Katchen
Address:	Phone #: 0
Brooks AFB, TX 0- 0	Source: Star Vol. 30, No. 4, N92-13549

Availability Category: D	CR1-	CR2-	CR3-	CR4-

Relevancy:
Neurolocical studies of flight crew vulnerability.

Summary:
The bottom line in aerospace neurology is the evaluation for the (1) potential of sudden incapacitation, e.g. post traumatic seizures; (2) possibility of a sudden neurological deficit which would prevent the aircrew member from performing their job and thereby affect mission completion, flight or personal safety, e.g. neurological deficit with headaches; and (3) risk of any neurologic or neuropsychologic deficit which would persist after the initial injury, e.g. post traumatic syndrome. Reasonable criteria for making an aeromedical decision in specific neurological syndromes are presented, and some work up guidelines are established. Areas of controversy are identified, and the aeromedical issues involved are raised.

See Also:

Date of Printout: 03/04/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/91 | RRI Control Number : R07L005

Title:
Aviation Psychology in the Operational Setting

Organization:
Name: Institute of Aviation Medicine
Address:
Oslo Norway
0- 0

Point of Contact:
Name: Grete Myhre
Phone #: 0- 0

Source: Star Vol. 30, No. 4, N92-13550

Availability Category: 0 | CR1- | CR2- | CR3- | CR4-

Relevancy:
Lessons learned- psychological factors related to aviation operations.

Summary:
Being an aviation psychologist in a small airforce has its advantages, since one has to cover a wide spectrum of tasks, compared to the aviation psychologists in a large airforce who has to specialize in one or two fields. The main tasks of an aviation psychologist are discussed and include the following: (1) teaching flying personnel aviation psychology; (2) acting as a consultant to the aviators on personnel matters; (3) performing surveys on the flying personnel social and working conditions; (4) assisting the flight surgeons on medical boards (5) acting as a member on aviation accident boards where human factors are involved, and (6) acting as a consultant in an operational setting. Two case histories are discussed that involve fighter pilots ejected from their aircraft

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 09/01/91 | RRI Control Number : R07L008

Title:
Unexplained Loss of Consciousness

Organization:
Name: School of Aerospace Medicine
Address:

Brooks AFB, TX 0- 0

Point of Contact:
Name: Marc S. Katchen
Phone #: 0

Source: Star Vol. 30, No. 4, N92-13553

Availability Category: D | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Summary of aviator loss-of-consciousness experience. Prevention of future incidents for safety.

Summary:
The unexplained loss of consiousness in aircraft crews is discussed, with emphasis on diagnosis. The several reasons for loss of consciousness are surveyed. The evaluation of unexplained loss of consciousness requires a detailed history from the subject and eye witness, and evaluation of vital signs and a physical and neurological examination, along with both detailed cardiovascular and neurological workups.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L011

Title:
Psychological Factors Influencing Performance and Aviation Safety

Organization:	Point of Contact:
Name: Letterman Army Inst. of Research	Name: James Picano
Address:	Phone #: 0
San Francisco, CA 0- 0	Source: Star Vol. 30, No. 4, N92-13558

Availability Category: R	CR1-	CR2-	CR3-	CR4-

Relevancy:
Analysis of pilot judgmement and hazardous thought patterns. Incorporation into aviator training.

Summary:
The psychological status of the pilot as it relates to performance is discussed. Two constructs related to this issue are explored: pilot judgment and hazardous thought patterns. The five basic hazardous thought patterns of anti-authority, impulsiveness, invulnerability, macho, and resignation are seen as precursors to faulty judgment. The five hazardous thought patterns represent an interesting exploration into pilot-centered processes which may mediate between an event and a pilots decision making outcome. These constructs are in need of further validation, but education about hazardous thought patterns and the individuals appraisal of his own decision making processes could be easily incorporated into an aviators continuing aeromedical education and training.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L013

Title:
The Failing Aviator

Organization:	Point of Contact:
Name: School of Aerospace Medicine	Name: John C. Patterson
Address:	Phone #: 0
Brooks AFB, TX 0- 0	Source: Star Vol. 30, No. 4, N92-13561

Availability Category: M		CR1-	CR2-	CR3-	CR4-

Relevancy:
Addresses performance degredation in aviators caused by psychological factors.

Summary:
The purpose is to increase the awareness and alertness in those who work with aviators about the early signs and symptoms of failure. Solutions can start by addressing the failure process early, by providing training in these areas of psychological functioning as parenting and marriage communication, by changing the selection process to include not only competitiveness and achievement, but also openness to emotional experience, and finally by improving the relationship between mental health providers, flight surgeons, and aviators.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT	Date of Report: 09/01/91	RRI Control Number : R07L015

Title:
Medical or Administrative? Personality Disorders and Maladaptive Personality Traits in (T)

Organization:
Name: David Jones
Address:

San Antonio, TX 0- 0

Point of Contact:
Name: David Jones, John Patterson
Phone #: 0

Source: Star Vol. 30, No. 6, N92-13566

Availability Category: N | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Analysis of behavioral disorders among aviators.

Summary:
Medical or Administrative? Personality Disorders and Maladaptive Personality Traits in Aerospace Medical Practice

Aeromedical/occupational decisions are hard enough to make when there is concrete evidence of disease, and they are even more difficult when the evidence consists of abstract symptoms rather than physical signs, as in the case of most psychiatric disorders. The behavior which is described concerns personality problems, which present as traits or as overt disorders.

See Also:

COGNITIVE SCIENCE

RRI Control Number	Title
R07A006	Air Traffic Controller Memory Enhancement
R07G002	Multimodal Interactions in Sensory-Motor Processing: 1991
R07L021	Multimodal Interactions in Sensory-Motor Processing: 1992

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 12/01/90 | RRI Control Number : R07A006

Title:
Air Traffic Controller Memory Enhancement

Organization:
Name: PERI, Inc.
Address:

Princeton, NJ, 0- 0

Point of Contact:
Name: Vingelis, P. J.; Schaeffer, E.
Phone #: 0

Source: STAR, N91-14713, Vol. 29, page 854

Availability Category: R | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Research effort design to help controllers reduce frequency of operational errors.

Summary:
The Federal Aviation Administration is engaged in an ongoing research effort to help air traffic controllers reduce the frequency of operational errors. The results of the first year's efforts in a three-year project to develop practical, effective memory aids to improve controller performance of tasks where memory is a critical element are given. Literature on controller memory and performance is reviewed and operational errors are analyzed to determine the nature and frequency of controller memory lapses. Several potential memory aids are identified and evaluated for effectiveness, feasibility, usability, acceptability, cost, and testability. The highest ranking memory aids are recommended for further evaluation in controller experiements.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 08/01/91 | RRI Control Number : R07G002

Title:
Multimodal Interactions in Sensory-Motor Processing Annual TechnicalReport, Jul. 1990 - Jul. 1991

Organization:
Name: Dartmouth College
Address:

Hanover, NH 0- 0

Point of Contact:
Name: See Summary
Phone #: 0

Source: Star Vol. 30, No. 6, N92-015539

Availability Category: R | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
Studies of human sensory-motor performance based on visual and auditory stimuli are applicable to aviation tasks involving hand/eye coordination and sound perception.

Summary:
Patricia A. Reuter-Lorenz, H.C. Hughes, Robert Fendrich, G. Nozawa, and M. S. Gazzaniga

We describe our progress in: (1) delineating the functional architecture of the human saccadic and attentional orienting systems (section 2) based on analyses of reaction times; and (2) development of accurate surface maps of the human neocortex in vivo from reconstructions of MR scans (section 3). Work carried out under AFOSR funding (2 in 90 - 91 year) provides the basis for our current model, which identifies two serially organized component processes in saccade generation (section 1.1). The early component is sensory; it's most noteworthy feature being the mode of convergence of visual and auditory information in the saccadic control system (section 1.2). In the subsequent pre-motor component, the processing time is partially determined by the state of fixation. Fixation point offsets facilitate saccade latencies by decreasing premotor processing times via disinhibition. These sensory and motor facilitory mechanisms can be combined to optimize human saccadic performance (section 1.1). The ultimate goal is to provide a model which accounts for human oculomotor performance in terms of physiologically plausible comoponent subprocesses.

See Also:

Date of Printout: 01/13/94

RELEVANT RESEARCH ITEM REPORT | Date of Report: 06/30/92 | RRI Control Number : R07L021

Title:
MULTIMODAL INTERACTIONS IN SENSORY-MOTOR PROCESSING

Organization:
Name: Dartmouth Coll
Address:

Hanover, NH 0- 0

Point of Contact:
Name: Michael Gassaniga
Phone #: 0

Source: Star V31/N4, N93-15067

Availability Category: R | | CR1- | CR2- | CR3- | CR4- |

Relevancy:
This report describes research into intersensory (visual/auditory) processing and its effects on response times for several different interaction response systems. Data from this research could help the FAA in evaluating human-computer interfaces for controllers.

Summary:
Intersensory (visual/auditory) facilitation of reaction times (RT's) was examined using three different response systems: saccadic eye movementsl, directed manual responses (deflections of a joystick towards the target location) and simple manual responses. The data were examined in the context of race models (in which facilitation is attributed to the minimum of two random variables representing the detection times associated with the visual and auditory targets) versus neural summation coactivation models (where the facilitation is attributed to a combination of the activities within the visual and auditory channels prior to detection.) The first experiment provides for evidence for neural summation coactivation in all three response model. The effects of varying combinations of auditory and visual stimulus intensity were examined in the second experiment. Intensity-dependent mismatches in the auditory and visual RT's had little effect on the magnitude of the redundant targets effect, indicating that visual-auditory integration occurs over temporal intervals of at least 40 msecs. The effects of spatial correspondence (auditory and visual targets presented in spatial register or in opposite hemifields) was examined in the third experiment. Coactivation depends upon the spatial alignment of the targets for directed responses (both saccades and directed manual responses) bust not simple manual RT's.

See Also: